SCIENTIFIC AMERICAN

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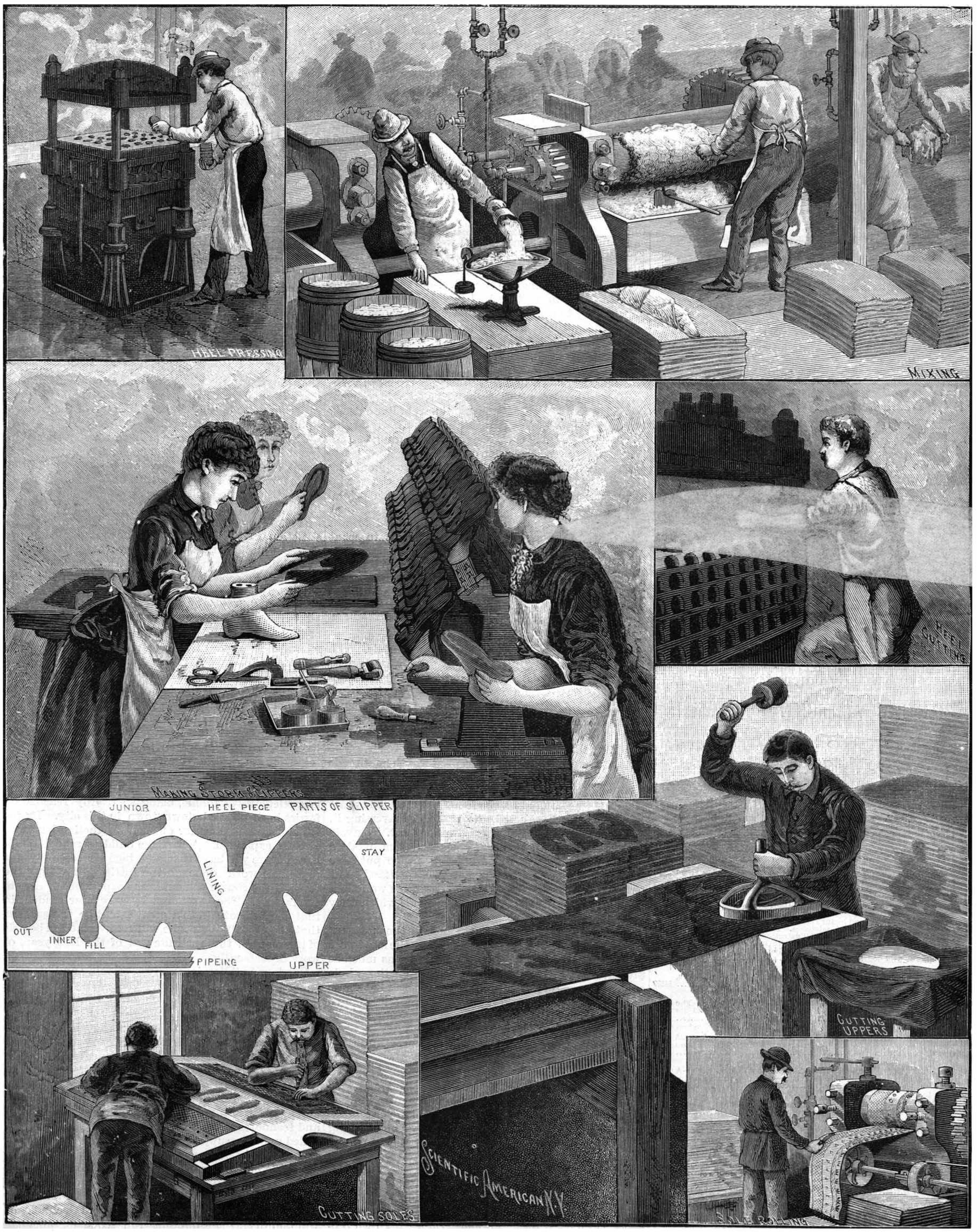

MANUFACTURE OF RUBBER SHOES—INTERIOR VIEWS OF FACTORY OF BOSTON RUBBER SHOE CO., MALDEN, MASS.—[See p. 374.]

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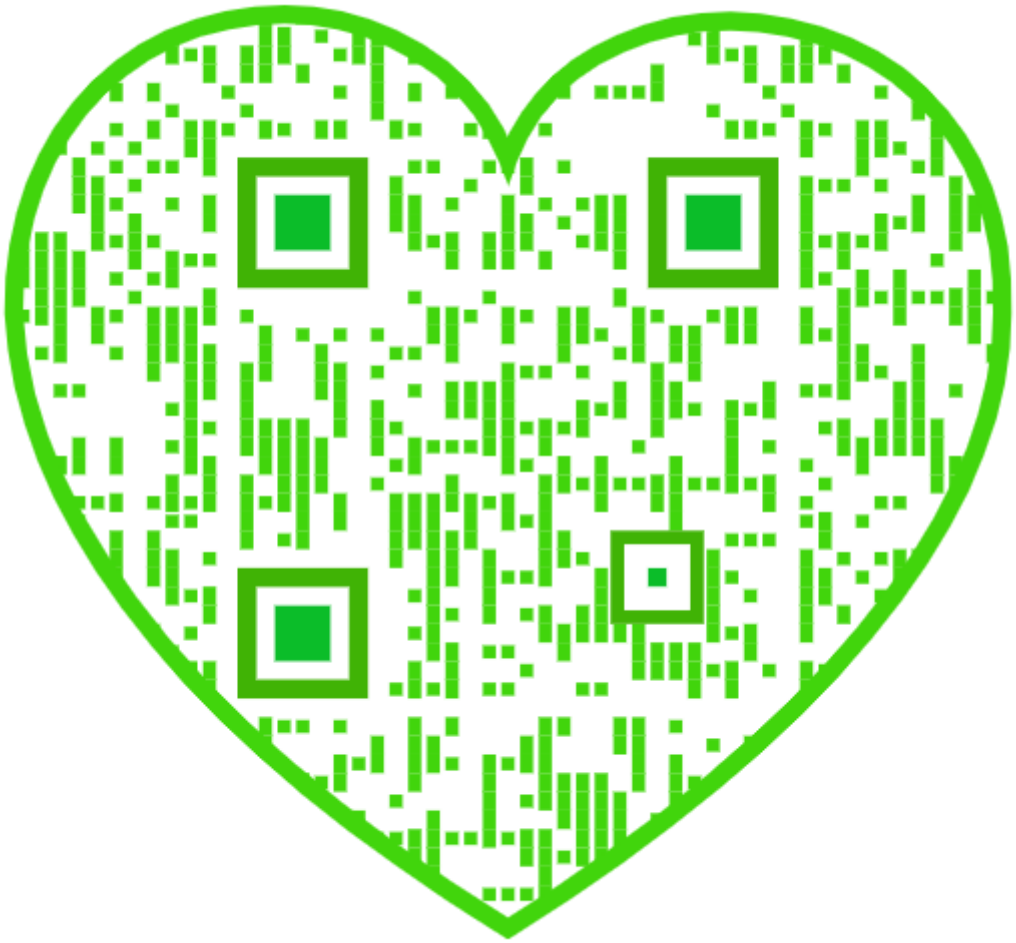

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THE DANFORTH CASE.

Danforth was an assistant engineer on the U. S. S. Philadelphia on a recent voyage. On the morning of November 5, he was in charge of the engine room and engaged in testing the capstan steam pipe with steam up. While his men were distributed at their stations here and there among the machinery, the master-at-arms, a subaltern in the marines or police of the ship, suddenly appeared, and, without a word to Engineer Danforth, forthwith arrested one of his machinists under orders from the deck, when Danforth interposed, insisting that an engineer in charge should be informed that one of his men was to be taken from his post, so that he could put another man in his place. The master-at arms quitted the engine room to report that he had been interfered with, and, in the meantime, Danforth, having relieved the machinist that was wanted, sent him on deck to obey the order of arrest. Then came an order for Engineer Danforth to appear on deck forthwith. Engaged as he was in superintending a test with steam up, so he testified, he could not leave at once. "I dared not leave my post at once," he says, "knowing that the chief engineer, my superior, would hold me to a strict accountability if mishap should come, and believing that the officer-of-the-deck only wanted to see me in reference to the case of the arrested machinist and was not aware that I was seriously engaged.

"I sent him word that I was testing the capstan steam pipe and would come just as soon as I could find some one to relieve me. Then a peremptory order came and, leaving everything, I went on deck. Within an hour after I had, with perfectly honest intentions and a conscientious belief that I was doing my duty, sent the message to the officer-of-the-deck, I had been reported in writing and had been refused any opportunity to make an explanation to any one of the three officers who were to make and forward the reports against me."

This testimony was not impeached before the court martial nor was it denied that Danforth is a faithful and efficient officer, his record being, up to now, without blemish. Notwithstanding this, the jury, composed it should be said for the most part of line officers, brought in a verdict against him; the Secretary of the Navy approving the same and condemning the engineer to a year's suspension on half pay.

The case has excited much interest throughout the service; the engineer officers, or at least those who have expressed their opinions in the public prints, looking upon the verdict as unjust and unmerited; though only what might have been expected from a strict application of the old cast iron rules to what must be regarded as altogether new conditions.

It is time this kind of thing was put a stop to, or, if the old rules must stand, that a little common sense be mixed with them.

GOOD ROADS.

The subject of good roads is now occupying a great deal of attention on the part of the public. The American nation appears to be gradually awakening to the fact that the bad roads of this country are unworthy of its position among the nations. We learn what bad roads bring about when we read of mud blockades. Large districts of country are rendered impassable by mud. Almost an entire State is brought into a condition of siege by the muddy roads. The farmers cannot transport their produce, the railroads lose freight, and the speculators seize the opportunity to advance prices of produce.

This is what a mud blockade may mean. The State or region directly affected, the railroads traversing it, and the country at large may all suffer for it. To avoid such occurrences we need no lessons from modern times. It is true that the nations of Europe put us to the blush. But we may go back two thousand years for our instructors. The Roman engineers won their fame largely as road makers. The roads which they built are to-day their monuments.

Thus we find ourselves very archaic in the matter of roads. It is stated that in Illinois alone the loss to the community from bad roads last year was as much as $16,000,000. If this ratio were taken for the whole country, it would give a loss of $300,000,000. At three per cent such loss would represent a capitalization of ten thousand millions of dollars. This is one-sixth of the total wealth of the country.

The subject of deserted farms has been a subject of concern in the New England States. A farm whose outlets in the spring and fall months are but canals of mud and cobblestones is justly unattractive to the young. They find the enforced isolation unendurable. But replace the bad roads by macadamized or telfordized surfaces, which do not feel the spring thawing and which are always passable, and which are dry a few hours after a rainstorm, and the country will take on a new aspect.

The agitation for good roads was originally undertaken by the League of American Wheelmen. This is an association of bicyclists. On bad roads the bicycle rider is at a great disadvantage. Doing his own propelling, he quickly appreciates a change in the road surface. The agitation began to spread. The carriage builders have justly felt that good roads would give them an enlarged market, and have joined the movement. The subject has been lifted up from the limited bicyclist's platform to a national one. A bill has been presented before Congress looking to the establishment of a national highway commission. Special laws have been passed by States for the construction of roads. The effect of such laws has already been widely felt. The formation of a national association for the encouragement of the building of good roads has been effected. The probabilities are that the next ten years will see a great change—almost a revolution. The era of bad roads is certainly approaching its close.

A CARRIAGE BUILDERS' SCHOOL.

The National Association of Carriage Builders held their 20th anniversary recently in Buffalo, New York. Among the subjects treated a particularly important one, and interesting in view of the general movement for the advance of technical education, related to the establishment of a carriage builders' technical school. For some time past a school has been maintained in New York City for the education of young men employed in the carriage factories, apprentices and mechanics who work during the day. These young men gave three nights each week in the carriage builders' school to learn carriage drawing. This is the work that has been done. The Carriage Builders' Association, however, felt that more was required, and advocated the establishment of a true technical school.

As the representative of practical technics in this vicinity the Stevens Institute at Hoboken afforded an obvious opening for the foundation of such a course. The Institute for many years has graduated from its curriculum engineers in the true, practical sense of the term. Its graduates are not only familiar with the mathematics of the subject, with the theory and scientific aspect of their work, but are also practical workmen when they leave it. Special provision is made for giving them a course in practical mechanics, so that they may learn the absolute use of tools. After they leave the college there is no need for them to spend a year or more in the shop. This part of their education is included in their college course.

The faculty of the college have taken a special interest in the carriage builders' school, such as it is. It seems very natural, therefore, that by a slight addition to its force, the Stevens Institute of Technology might supply the needed college for carriage builders. Evening classes in drawing and designing should be kept up for the benefit of workmen and apprentices. Instruction in connection with the regular course in drawing and descriptive geometry would be included in such lines as are required in carriage building. Under applied mechanics the application of the principles of statics and dynamics to suitable problems in carriage building would be given. In shop work the joints used in carriage construction and the tempering of springs are two suggested topics. In the experimental course special examples in testing the strength of springs, joints, and frames would be introduced.

Such in general, with added lectures by specialists, is the programme as suggested by Dr. Henry Morton, the President of the Institute. To carry it out, money is required, and the collection of such money is now being attended to by the association, and they seem to believe that they will succeed in raising sufficient capitalization to enable the Stevens Institute of Technology to establish the special course designed.

The situation of the Stevens Institute of Technology is particularly available, being so readily reached by ferries both up and down town in this city. Its peculiar fitness as a center of such instruction has been already explained. A carriage builders' school established there will have the advantage of a score of years' preceding work done at the Institute, for into the work of the course will enter the experience of the entire faculty. The work done by a regular student in that department will to a great extent be the same as that done by all, so that he will receive the full benefit of the plant of the Institute and of the long years of work of its faculty.

Carriage building is rapidly developing and bids fair to become a true profession. The past year has witnessed remarkable results obtained by the introduction of ball bearings and pneumatic tires on racing wagons, and it is hard to believe that the day is not near at hand when vehicles of luxury will be thus equipped. In the structural department electricity is already playing a part in the welding of tires and in the welding and brazing of joints in general. All this indicates the invasion of the old field of handiwork and apprenticeship by the highly trained mechanic and technologist. The carriage factory may yet be called upon to supply electrically propelled vehicles. Many experimental vehicles of this type have indicated the possibility of future success. In the use of oil fuel and of naphtha engines there is also a possibility for the future. In carrying out these and many other impending changes the educated technologist will find in carriage building full scope for an engineer's education.

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THE NICARAGUA CANAL CONVENTION.

At the recent New Orleans convention, which was attended by prominent business men from many sections of the country, the main effort was to bring to bear upon Congress sufficient influence to secure government aid in building the Nicaragua Canal,* such aid to be extended in such way as to give the government almost sovereign power over the work. Senator Morgan, of the Committee on Foreign Affairs of the United States Senate, made the principal speech, in which he insisted that the bill now before the Senate, providing for the indorsement of $100,000,000 canal bonds, ought to be passed, and receive the hearty approval of all intelligent citizens. He said the canal company was willing to give to the government $70,000,000 of the bonds, in order to lodge the control of the canal in Washington, and thought that the concession of a neutral strip of land along the canal by Nicaragua would prove to be really the cession of so much territory to the United States. A strong committee was appointed to urge upon Congress "to take such steps and give such financial aid as will insure the speedy completion of the canal at the minimum cost thereof, taking proper security for any credit pledged or money advanced for this purpose, and retaining such control and supervision of the same as will insure the peaceful use of this great enterprise to the commerce of the world at the lowest possible rates."

To Darken Oak.

Oak for decorative wood work is produced by fumigating the material with ammoniacal vapor, which effectively produces the dark coloring so much desired. In accomplishing this, the method consists in placing the material to be darkened in an approximately air-tight room in which no light enters; or for small work a packing box will suffice, the joints or cracks to be well pasted over with paper. In this room or receptacle for depositing the furniture or other articles is placed a flat porcelain or earthen vessel filled with ammonia, the vessel containing the liquid being, of course, set on the ground or floor, that the fumes or vapor may strike to advantage the articles to be darkened; if the apartment is large, two or more vessels containing ammonia may be employed and allowed to remain until the desired effect is secured. The ammonia does not touch the oak, but the gas that proceeds from it acts in a peculiar manner upon the tannic acid contained in oak, browning it so deeply that a shaving or two may actually be taken off without removing the color. The depth of shade depends upon the quantity of ammonia used and the duration of exposure.

A Demonstration of the Cholera Bacillus.

At a recent meeting of the Section in General Medicine of the New York Academy of Medicine, Dr. E. K. Dunham gave a most interesting demonstration of the comma bacillus of Asiatic cholera. Tube cultures and plate colonies of the organism were projected upon the screen, and their morphological and biological characters pointed out. The bacilli themselves were shown under the microscope, both alive in a drop of the culture fluid and also stained by the ordinary methods. Photomicrographs of the latter were also shown by means of the dark lantern. The cultures had been made in the usual way from the dejecta obtained from the nine cases of cholera recently observed in New York. In two of the cases cover glasses, prepared directly from the intestinal contents, showed the characteristic germ. In the seven other cases cultures had been required before the bacillus was found. Cultures from some of these cases had been sent to Dr. Petri, director of the bacteriological department of the Imperial Board of Health at Berlin, and a letter in reply had been received from Dr. Petri stating that he could detect no difference between Dr. Dunham's cultures and those made from the cases in Hamburg.—*N. Y. Med. Jour.*

Oil of Sweet Almonds.

The United States consul in Liverpool recently received orders from government to inquire into the manufacture of oil of sweet almonds in England. He reports that two London firms, whom he names, seem to be the principal, if not the only, firms in England engaged in this business. The kernels are crushed by hydraulic pressure, and from the cake thus formed the oil is distilled. The same process is carried on in Havre; but it is said that there the kernel of the peach is used instead of the almond, and that, consequently, the oil is cheaper in price and not so good.

THE use of rubber tires on private carriages has become quite common in this city. For invalids and nervous persons our physicians recommend their use. But the rubber tire is not only expensive, but lasts only a little while, owing to our rough pavements and street railway tracks. Why will not some one invent a cheaper substance than rubber, which will be more enduring, cost less, and be sufficiently elastic to meet the requirements?

*Illustrations and full details of the canal and its cost may be found in SCIENTIFIC AMERICAN SUPPLEMENTS 683 and 687.

Menthol.

The medicinal use of menthol in China and Japan goes back into the dateless ages. Isolated references to its application in the East are met with here and there in the records of western travelers in those parts, but, says the *Chemist and Druggist*, we shall probably never know the name of its discoverer or the early history of its introduction. We do not even know with absolute certainty when, and by whom, menthol crystals were first brought to the notice of European pharmacologists. It is said that they have been used pharmaceutically on the Continent as long ago as the end of the last century, but if that statement is capable of proof, the drug must have fallen into oblivion shortly after its introduction, for it was certainly utterly unknown, even by repute, to most persons in the drug trade twenty-five years ago. Somewhere about 1864 a consignment of the drug was received in London under the name of Chinese peppermint oil, and passingly commented upon for its curious property of solidifying with a fall in the temperature. To the late Mr. John Mackay, of Edinburgh, belongs the distinction of first having called the attention of British pharmacists to the valuable properties of menthol. Mr. Mackay is believed to have brought "Po-Ho oil" with him from Paris, where it was then sold, in the small red-labeled Chinese bottles familiar to eastern travelers, as a kind of proprietary article. Had menthol been an utterly valueless quack medicine, it would, perhaps, have taken Europe by storm then, and reigned for a season, just long enough to gather a fortune for its first exploiter. But as the drug happened to have a solid therapeutic value, it had to wrestle through the familiar stages of contumely, ridicule, animosity, and unreasoning popularity, just like any new creed or reformer. The commercial history of menthol practically dates from 1878, when an English firm in Yokohama made a small shipment of it to London, determined not to rest until they had succeeded in securing for the remedy a footing upon the market. After many months their shipment went back, with a note from the agents, announcing that "the stuff" could not be sold here, as no one knew what to do with it. But the Yokohama firm persevered, and they reaped their reward. Four years later menthol crystals were the rage of the season, selling at 60s. per lb. wholesale, and carried about in cone shape by all persons with any pretense to the possession of a civilized nervous system.

Lysol.

Attention having been drawn by the recent cholera "scare" to the popularity of carbolic acid as a disinfectant, notice is being taken in medical circles of the even superior advantages for many purposes of the cresols as disinfectants. It was discovered that crude carbolic acid made soluble by the action of sulphuric acid surpassed in germicidal power an equally strong solution of pure phenol, besides which creolin, although free from carbolic acid, was proved to be of unmistakably superior disinfecting activity to the latter. Being insoluble in water, however, these cresols were neglected until the idea was hit upon of combining them with resin soap. Although very efficacious, these preparations were only emulsions; and it remained for the cresols to be made soluble, as now in the form of lysol, in order that what can be called the ideal soluble disinfectant should be made generally available. Lysol is produced by dissolving in fat, and subsequently saponifying, with the addition of alcohol, the fraction of tar oil which boils between 190° and 200° Cent. It is a brown, oily-looking, clear liquid, with a feebly aromatic creosote-like odor. It contains 50 per cent of cresols; and it is miscible with water to a clear, saponaceous, frothing fluid. It shows turbidity when mixed with hard water; but its disinfectant quality is not impaired thereby. It acts, to all intents and purposes, as a soap; and it is admirably adapted for use in surgical operations. According to German testimony, lysol is one of the most precious products of coal tar which chemistry has given to the service of mankind.

Waterproof and Fireproof Cement.

Herr Alwin Nieske, of Altherzberg, suggests a method for the preparation of an absolutely waterproof cement, consisting in the addition to ordinary cement of acetate or palmitate of alumina. By further adding chromate of magnesia to this mixture, the cement is made refractory as well as moisture-repelling. The idea is that cement of this character would be advantageous for use in very damp situations, or for tanks, etc., underground. The proportion of palmitate of alumina to be employed will vary according to circumstances, the nature of the mortar or cement, and the character of the work to be done; but 10 per cent of the palmitate would be a good proportion for any kind of hydraulic mortar. If the cement is needed to resist humidity, and be at the same time refractory to fire, a mixture is made in about equal parts of the cement mortar with the palmitate and a chromic magnesia prepared with oxide of chromium, 32 to 42 parts; alumina, 18 to 22 parts; magnesia, 18 to 20 parts. The mixture of these earths, wetted with water, is formed into briquettes, which are calcined, pulverized, and kept ready for use.

Method of Capturing Mosquitoes.

An ingenious method of capturing adult mosquitoes in the house is in extensive use in some localities in New Jersey. We have not seen it described in print, and mention it here in the hope that it may be new to some of our readers. It consists in nailing to the end, or rather the top, of a stick the lid of a small tin box, such as a yeast powder box. The stick must be long enough to enable the operator to reach the ceiling, and the tin cover of the box is nailed to it in an inverted position. Into this receptacle is then poured a tablespoonful of kerosene, and the mosquitoes at rest upon the ceiling are easily trapped by simply placing this kerosene cup under them and close up to the ceiling. In their endeavor to escape they fall at once into the kerosene and are killed. On the morning of September 25 the writer captured in this way seventy-five mosquitoes on the ceiling of the room which he had occupied during the night. Most of the seventy-five were filled with blood, which, we think, is a sufficient argument in favor of performing the operation before going to bed rather than after arising!—*Insect Life.*

Gigantic Steel Works.

The Carnegie Steel Company, limited, was organized last July with a capital of $25,000,000. Record has recently been filed at Pittsburg. The *Bulletin* has the following list of stockholders in the new company: Andrew Carnegie heads the list with $13,833,333, or $1,333,000 more than the controlling interest. The other large stockholders are: Henry Phipps, Jr., who holds $2,750,000; H. C. Frick, $2,750,000; G. Lauder, $1,000,000; W. H. Singer, $500,000; H. M. Curry, $500,000; H. W. Borntraenger, $500,000; J. G. A. Leishman, $500,000; Wm. L. Abbott, $250,000; Otis H. Childs, $250,000; and J. W. Vandervort, $200,000. There are twenty-three stockholders in all. The works included in the reorganization are the Edgar Thomson, Homestead, Duquesne, Upper and Lower Union Mills, the Lucy Furnaces, Keystone Bridge Works, Beaver Falls Mills, the Scotia Ore Mines, the Larimer Coke Works, and the Youghiogheny Coke Works.

Drake's Columbus Drinking Fountain.

At a cost of fifteen thousand dollars, John B. Drake, proprietor of the Grand Pacific Hotel, and one of Chicago's leading citizens, is just completing in that city a public drinking fountain, which is regarded as one of the most ornamental creations of its kind in the world. The design is Gothic in style, and the material is a fine warm-tinted coral granite from Italy. The structure occupies a space on the north side of Washington Street, between the city and county buildings, and is 32 feet in height. Below the platform is a chamber which will hold three tons of ice, effectually cooling the water, which flows through coils of pipe below and around the ice.

Mr. Drake has long felt that public drinking fountains in the populous parts of great cities would promote the cause of temperance in the best possible way. Let Mr. Drake's good example be followed by citizens of other cities and towns.

Where Canary Birds Come From.

When the North German Lloyd steamer Herrmann unloaded at New York lately, twenty large bundles shrouded in white cloth were carefully lifted from the hold and placed on the dock. From each bundle came a chorus of angry twitterings and chirpings and much fluttering of wings. Each bundle contained 252 little wooden bird cages, each with a canary bird in it. Immediately every one of the 5,040 birds stretched its little yellow throat in an effort to outsing his neighbor. They carolled and trilled as merrily as if they were looking out on green heath and a blue sky.

The canaries are of three grades; the $2.50 birds, the $5 birds, and the $10 birds. The ordinary birds are worth $2.50. A large, fine bird, or one of particularly handsome coloring, brings twice that price, while a distinguished vocalist will bring $10. All the birds are males and singers. They come from Germany, where they are bred in large numbers. It is probable that all of the 5,040 birds will be sold within a few weeks. This is the busy time in the canary market, and within the past week more than 10,000 of these birds have arrived, classed as live stock.

A Large Hydraulic Ram.

Rife's Hydraulic Engine Manufacturing Company, Roanoke, Va., has recently built a hydraulic ram which yields remarkable results. It is attached to an 18 inch drive pipe with a 4 inch discharge pipe, and weighs a ton. This ram, under a head of 7 feet, elevated a gallon of water per second to a height of 34 feet. It is said that during the experiment the ram took in the requisite quantity of air and worked very steadily and satisfactorily. It has thus been demonstrated that it is quite within the range of possibilities to make larger hydraulic rams than have heretofore been thought of.

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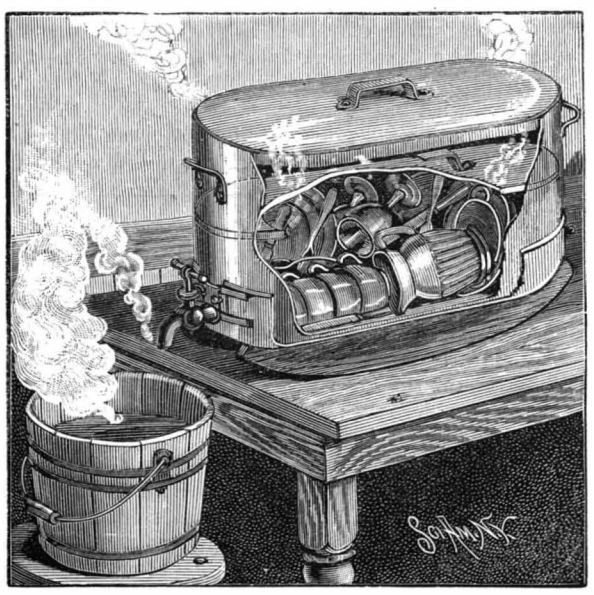
AN IMPROVED DISH WASHER.

A simple and inexpensive device for speedily cleansing dishes or other soiled table ware, in a very convenient manner and with small chance of breakage, is shown in the accompanying illustration, the improvement being the invention of Eliza A. H. Wood (deceased) and Mrs. Minni Wood Gordon. The dish holder has a closely-fitting removable cover, and a faucet near the bottom at one end, for freely draining off the water, while within the holder freely slides a comparatively heavy loose lid, designed to rest on the dishes and hold them in place after the hot soapy water has been poured upon them. The holder rests in a cradle, on the lower side of which are rockers, the cradle having a low border wall and flat bottom, and a slot in each end of the border wall of the cradle accommodating the faucet. When the unwashed dishes have been packed in the holder, the hot soapy water



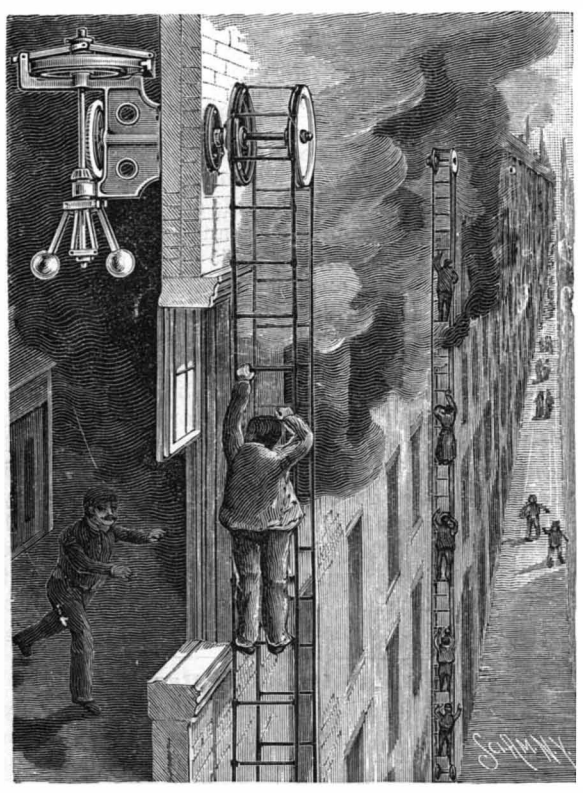
THE WOOD-GORDON DISH WASHER.

poured over them, and the heavy inner lid placed on them, the outside cover is put on and the entire device rocked, to cause a thorough and rapid circulation of the soapy water through the dishes, after which the first water is drawn off and rinsing water used, as desired, in the same way.

Further particulars with reference to this invention may be obtained of Mrs. Minnie Wood Gordon, Bloomfield, Fla.

AN IMPROVED FIRE ESCAPE.

The fire escape shown in the illustration is operated automatically by the weight of the persons escaping from a building to which it is attached, the improvement being designed to supersede the employment of cumbersome and dangerous iron ladders, ropes, cables, etc. The invention forms the subject of a patent recently issued to Mr. William J. McCollum, of No. 182 Van Houten Street, Paterson, N. J. At a suitable point near the windows in the outside wall of the building, near the ceiling of the upper story, is secured a tube, whose inner end is integral with a cast iron bracket



McCOLLUM'S FIRE ESCAPE.

carrying the regulating mechanism of the device. The tube forms a bearing for a freely revolving horizontal shaft on whose outer end are two sprocket wheels, at a suitable distance apart to represent the width of a ladder, the notches in the wheels being spaced to correspond with the distance between two of the rungs of the ladder, the rungs being attached to endless wire ropes. On the inner end of the upper shaft is a miter wheel in gear with a pinion, by means of which a governor is operated to control the speed of revolution of the shaft, as it is rotated by the weight of one or more persons stepping on the ladder. By the operation of the governor a steel brake band is made to bear upon a brake wheel with a pressure corresponding to the weight which may be placed upon the ladder, enabling persons to descend at a safe and uniform speed, and insuring perfect control, whatever the load. The governor may be regulated to run at any speed desired. When the occupants of the ladder alight the mechanism ceases revolution, a pawl preventing the descent of the other side of the ladder at any time, and enabling it to be used when desired to gain access to the building. To prevent the ladder from becoming slack by wear or changes in temperature, the shaft carrying the lower notched sprocket wheels forming the bottom of the ladder has its bearing in a hollow tube, to which are secured eccentrics with enlarged collars adapted to be clamped by lock nuts, whereby the distance between the top and bottom wheels may be regulated. The rungs of the ladder are tubular, and the entire apparatus is incombustible. The wire rope ladder and the sprocket wheels are galvanized, and therefore will not rust. The regulating device being inside of the building and the main shaft bearings in the wall, these parts are entirely protected from the weather. The wire rope forming the sides of the ladder is passed through bored apertures in the ends of each rung, and firmly fastened by means of a wedge, whereby a very strong ladder is made at a minimum expense, and, being very light, is not in any way a detriment to the appearance of the building. A basket may be hooked on to the ladder for children, or in other cases when desired, and the apparatus may also be used with great advantage as a lowering device for use in warehouses, mills, etc.

Nose and Throat.

In a recent lecture before the Chemists' Assistants' Association, London, by William Hill, M.D., London, the throat was described in detail, and the pharynx and the larynx pointed out as the two most important parts. The nose has a very important connection with the throat and its disorders. It contains a series of bones called the turbinated bones, which expose a large surface of warm blood, and cause the air inhaled to be warmed ready for the lungs; moreover, the cilia of the nose cause the secretions to move and reject the solid particles it has collected. The nose is the proper organ for breathing, not the mouth. The larynx, which is the air passage, is bounded at its upper extremity by the vocal cords, and has, therefore, the double function of breathing and of phonation. The epiglottis, by altering its form, causes the food to pass down the pharynx, and keeps it from the larynx. In speaking of proper breathing, the author pointed out that diaphragmatic breathing was the proper method, and not clavicular. It was reported that Rubini had broken his clavicle during singing, by persisting in this method of breathing. Throat diseases are often caused by germs, by inhalation of sewer gas, etc. Fortunately, there are other organisms in the throat always ready to attack these germs. The throat was well provided with tonsils, both faucial and lingual. The tonsils produce phagocytes, or leucocytes, amœboid corpuscles which actually swallow up the germs. Why, then, should tonsils be cut out? Because, when they become enlarged and horny, they lose this function, and by removing the horny surface, the newly exposed portion can go on producing the corpuscles. The decay of teeth is largely due to germs. This shows the importance of keeping the teeth in order. Obstruction in the nose is the cause of many throat disorders. Care must be exercised in the use of both alcohol and tobacco; many people can use these luxuries with impunity in moderation, others cannot. People liable to throat disorders should be very chary of eating piquant or hot dishes. Irritating remedies, too, such as cayenne and (except in special cases) tannin lozenges or nitrate of silver, should be avoided. Hot tea, too, is bad.

Painting the World's Fair Buildings.

The painting and decorating of the vast interiors of the great exhibition halls at Chicago is an enormous undertaking. Frank Millet is the artist in charge. A recent estimate of the area to be covered with paint developed the fact that it would be impossible to set enough men at work with brushes to complete the task in time for the opening of the fair. Mr. Millet thereupon contrived a machine for doing the work. It consists of a piece of gas pipe flattened at one end to make a "spray." From this a rubber hose connects with an air pump driven by an electric motor, and beyond this is a barrel of paint. The pump sucks paint from the barrel and the air jet sprays the paint with force upon the surface to be coated. Four workmen with this mechanism can accomplish more in a day than a small army of painters could in a week.

AN IMPROVED WOODEN VESSEL.

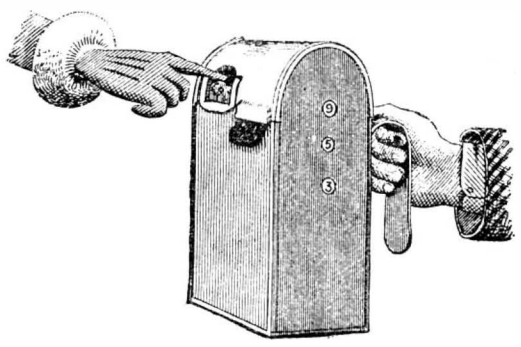
Ordinary buckets and tubs are being replaced in the South and West by the more expensive but more durable fiber ware and galvanized iron vessels; but the difficulty heretofore experienced with wooden buckets is designed to be obviated by the improvement shown in the illustration, as the staves are thereby prevented from warping in dry seasons, and are securely held in place and tightened when carrying a heavy load in the vessel. The invention has been patented by Mr. Edwin M. Reese, of Santa Paula, Cal. On opposite sides

REESE'S IMPROVED BUCKET.

of the upper hoop, a bolt extends through an opening in a stave, and engages at its inner end a brace or segmental hoop, fitted in a recess on the inside of several adjoining staves, the bolt at its outer end engaging an eye on the lower end of a vertically sliding link, which has a hook at its upper end to which one side of the bail is connected. The opening in the stave through which the bolt is passed is of a form to allow room for an up and down movement of the outer end of the bolt, and when the bucket is manufactured the upper hoop is located near the lower edge of the opening, the bolts then being inclined downwardly, as shown in one of the small sectional views. The opening in which the bolt moves is filled with asphaltum, putty, or other suitable material, and when the staves dry up, or there is a heavy load in the bucket, the lifting of it by the bail tends to draw the hoop and the bolts to an upper position, as shown in the other of the small views, thereby closing and tightening the upper ends of the staves to take up possible shrinkage.

A COIN-TAKING AND TICKET-DELIVERING BOX.

By means of the improvement shown in the accompanying illustration, when a coin is pushed into the box, a bell rings and a numbered ticket is delivered, an indicator at the same time recording the number of tickets issued. The invention has been patented by



WILLIAMS' AUTOMATIC CHECK BOX.

Mr. John Williams, of Patricroft, Manchester, England. Within the casing are spring-controlled locking devices, extending into the slideways of the coin-receiving opening, so that the coin, when placed in the mouth of the device, cannot be removed, but causes a drum to be revolved to deliver the ticket. Only one ticket at a time can be removed or automatically delivered from the box.

Further information relative to this invention may be obtained of Mr. Edward Haynes, No. 128 Pearl Street, New York City.

Bouillie Bordelaise.

This preparation has been proved to be a specific for the potato blight caused in Europe by the *Phytophthora infestans*, and the following formula for its preparation appears in the Kew *Bulletin* for October:

Copper sulphate	45 lb.
Quicklime	22½ "
Water	220 gal.

The sulphate is dissolved by suspending it in a coarse cloth, in a wooden vessel containing the water. Slake the quicklime in a separate vessel, and after stirring thoroughly with added water, pass it through a sieve into the copper solution, stir well, and add the remaining water. The quantity specified is sufficient for one acre of land.

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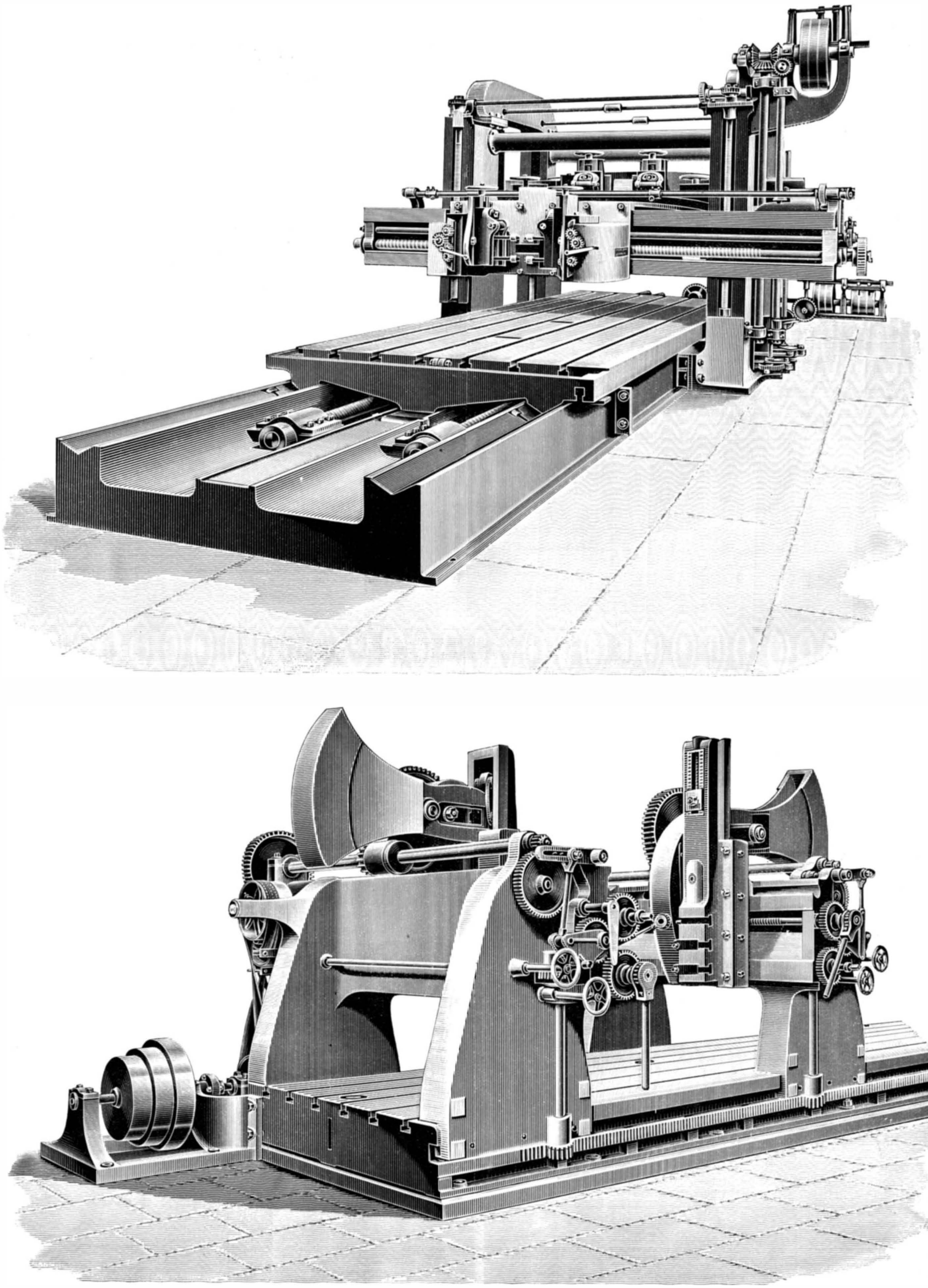
ENGLISH MACHINE TOOLS FOR AMERICA.

Under this head our London contemporary, the *Engineer*, gives illustrations, which we reproduce, of some new machines, lately made in England for the Carnegie works, and remarks upon the same as follows: "Our friends in the United States cannot as yet wholly dispense with English assistance, and find it to their advantage to apply to the English tool makers when they want thorough excellence. We illustrate a planing machine and a slotting machine, supplied this year to Messrs. Carnegie, Phipps & Co., of Pittsburg, by Messrs. Smith, Beacock & Tannett, Victoria Foundry, Leeds. The former is to plane armor plates to 30 feet long by 10 feet by 5 feet, and to plane both ways, and is fitted with a cross breast slide, also to plane both ways. The table is actuated by two strong steel screws with long gun metal nuts, ample thrust bearings, and intermediate supports. The driving is done by bevel wheels of cast steel, and wrought iron pulleys for the forward and backward motions, and self-acting belt guides. There are four strong stand-



IMPROVED ARMOR PLATE PLANING AND SLOTTING MACHINES.

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ards securely fixed to the bed and to each other, and placed face to face. The two cross slides, also placed face to face, are raised and lowered by power for adjustment, and each is fitted with two independent self-acting adjustable tool boxes for all angles. The weight of this machine is over 120 tons.

"Last year Messrs. Smith, Beacock & Tannett made for Messrs. Carnegie, along with other machine tools for cutting armor plates, the double-headed armor plate slotting machine which we illustrate, with a bed 35 feet long. There are two strong cross slides, each with standards cast thereto, admitting in width 6 feet 6 inches and 20 inches thickness of armor plate. The machine has strong carriages and slotting rams, with adjustable strokes up to 20 inches, with quick return double-purchase driving gear, and balance weights slightly in excess of that of the rams. There are self-acting motions for feeding longitudinally on the bed by racks and pinions and worms and wheels, and transversely on the cross slides by screws. There is a quick motion for running the slotting heads to and fro on the bed to position required."

American Earthquakes.

RALPH S. TARR.

The Japanese count upon an average of one violent earthquake shock in twenty years, although prior to that of October 28, 1891, there had been no alarming shock for about thirty-two years. Scarcely a day passes without a tremor in some part of the kingdom, and every year records more than one shock which in our country would be the cause of alarm. The people of Japan have become accustomed to quakings of the earth, and it requires some very violent shaking up accompanied by the destruction of much life and property to attract universal attention. Since 1633 there have been twelve such shocks, including that of last year, which destroyed in the neighborhood of 8,000 lives, wounded 10,000 more and wrecked not far from 90,000 houses.

In certain parts of Italy, as well as in Japan, the constant trembling and quaking of the earth has taught the inhabitants, through centuries of experience, that an effort to counteract the effects of earth quakings is well worth undertaking. By far the greater loss of life in an earthquake shock comes directly or indirectly from the falling of buildings; and we find accordingly an effort in regions subject to this evil to construct buildings which are calculated to withstand all but the most violent shocks. In our own country no thought is given to this matter, and our buildings, instead of being calculated to withstand earthquakes, are peculiarly well fitted to become death-dealing instruments in the hands of instable nature.

It is this thought which has induced me to write this article, in which it is proposed to review the points which bear upon the possibility of earthquake shocks in our densely populated Eastern States and to call attention to the widespread disaster which would result if our land should be visited by a violent earthquake, or even by one of slight violence.

In considering the possibility of an earthquake shock in any given region there are two sources to which one may go for facts. These are the historical record and the study of geological conditions. Both of these promise us comparative immunity from earthquakes, yet both point out clearly that we are liable at any moment to find ourselves violently shaken, though when this may come, or where, no one can tell. I wish to enter into these two inquiries somewhat more in detail and to place before the readers of this journal the facts as we know them, and to do this it seems well to inquire a little into the cause of earthquake shocks.

The proximate cause of an earthquake is the arrival upon the earth's surface of a series of waves resulting from a jar. An explosion of dynamite will serve as well as any other cause to start these waves in motion, and this is what actually did happen when Hell Gate was blown up a few years ago. The waves start out in all directions, tending to move as successive spheres, but of course being distorted as they pass through rocks of different densities. They reach the surface in a more or less circular form, and places approximately at the same distance on either side of the epicentrum or point directly above the center or focus feel the shock at about the same instant. The shock is most violent directly above the focus and diminishes as you recede from this point. At the epicentrum the motion is vertical, and tends to cause the roof of a house to fall to the cellar and leave the walls standing; but away from the epicentrum the waves emerge at an angle, and the effect is to overthrow houses, chimneys and monuments in the direction from where the waves proceed.

Whatever the cause of the earth jar, these are the universal effects. It is much less easy to state the cause of the jar. Probably, however, nine-tenths of the earthquake shocks are directly or indirectly connected with volcanic action or at least with the passage of molten rocks through the more solid strata of the earth's crust. It is as nearly certain as a thing can well be without actual ocular demonstration that this is the cause of very nearly all the earthquakes of volcanic regions, and these constitute the vast majority of earthquakes. Many such shocks can be connected with eruptions, and some, such as that of Krakatoa, in 1882, are the direct result of the blowing up of a crater by the pent-up lava. In other cases these earth jars are less easily assigned to volcanic activity, even though they occur in volcanic regions. Still it is a fair inference that this is their cause, for there must be a frequent passage of the liquid lava at great depths in the vicinity of volcanoes, even though no eruption results therefrom. Every time this molten rock, in struggling to reach the surface, forces a passage upward, even for but a small distance, its success in rending the rocks is telegraphed to the surface as a wave of motion and is recorded there as a trembling of the earth.

From this cause we in eastern America are happily free, and it is for this reason, in part, that we have more confidence in the stability of the earth than dwellers in lands of volcanic activity. There is good evidence, however, that the subterranean activity of molten rock is not confined exclusively to volcanic regions. Where one volcano is established there are probably many unsuccessful attempts to establish a vent or safety valve to the surface. Dikes of eruptive rocks intruded into the rocks in Central New York, for instance, where, since those rocks were formed, no volcano has existed, are proof of this. The intrusion of such dikes causes the rocks to be rent asunder, and each one must have caused at least one jar of greater or less violence upon the surface of the earth. How many of the earthquakes which have occurred far away from any volcano can be attributed to this cause cannot, of course, be said, but it is a possible cause and probably an actual cause of many. There is some reason to suppose that this may have been the cause of the shock at Charleston, S. C., in 1886.

In mountainous regions, where the rocks are bent and folded, the strain under which they are placed is liable at any moment to be relieved by breaking and the slipping of the rocks past one another in the plane of fracture, or the fault plane. In this event a single shock or many successive shocks of greater or less violence will result. The violent earthquake shock in New Zealand, in 1855, was due to this cause, as we know by the fact that the plane of fracture was visible upon the surface.

Such shocks have undoubtedly occurred in many parts of the Cordilleras, notably in the vicinity of Salt Lake City, where the fault scarps are still visible; and there is every reason to prophesy that they will occur again.

Nor are these faults confined to mountain regions. It is now known to geologists that there is such a fracture plane extending from near New York to the Carolinas, and marked where it crosses the larger rivers by waterfalls or rapids just above tidewater. If the slipping is still in progress along this plane there may at any time be an earth jar sent out from some point in the fault. Still, although there is danger from this cause, it is much less menacing east of the Rockies than in the Cordilleras. The reason for this is that our Eastern mountains are old and no longer growing, but, on the contrary, being worn away, while the Rockies and Sierras are still growing. In South America this growth of mountains is so rapid that it has been recorded within the last century by a considerable change in the relation of land to sea. The Cordilleras do not seem to be growing so rapidly, although it must be borne in mind that we have not in this case the datum plane of sea level at hand for comparison, as in the case of the Chilean Andes.

Another possible cause of earthquake shocks is the collapse of caverns, and to this cause it is probable that many shocks of minor importance in limestone regions may be referred. It is hardly probable that any violent earthquakes can be referred to this cause. It is not at all unlikely, also, that imprisoned gases attempting to escape may serve to jar the surface, perhaps even violently. How far this is a *vera causa* I cannot say, but it may perhaps have been the origin of some of the earthquakes in delta regions, and there are some facts connected with the earthquake of 1812 in the Mississippi valley which point to this conclusion.

Studied from the standpoint of cause and effect, we of the Eastern States are justified in feeling a certain degree of confidence in the stability of the earth, but there are possibilities which tend to disturb this feeling of security. That the rocks in many parts, as, for instance, in New England, are in a state of strain is undoubted. In the granite quarries of Cape Ann, in Massachusetts, blocks which are blasted out expand so that they cannot be placed back again, and there have been cases where the granite has bulged up and snapped, sending a miniature earthquake shock through the quarry. Moreover, in our confidence, we should not forget that regions which have for years been free from earthquake shocks are liable to be visited at any time. The frightful earthquake at Lisbon in 1755 is to the point. Without the slightest warning and without the least reason to expect danger, this city was visited by one of the most terrible earthquakes on record—a shock which was felt in Scandinavia, in Algiers and on the shores of our great lakes, and which in Lisbon alone killed not far from 60,000 people.

It has been urged that our Eastern States have been for many centuries, perhaps for thousands of years, practically free from earthquake shocks of any considerable magnitude. The basis for this argument is that there are in many places perched bowlders, and rocking stones and instable columns of rocks which could not have withstood any very severe earth jar. Even if we should grant this deduction it would not of course promise us immunity from such shocks in the future. These facts certainly do not prove that there have been no shocks of sufficient magnitude to cause great destruction to our poorly constructed buildings; for, although the perched stones have the appearance of instability, they are often much more stable than even a well constructed building of five or six or more stories. While this argument certainly has much force, it is of less value than might at first sight appear; for earthquakes are peculiar in their action, and often produce much destruction in one place and leave a neighboring spot comparatively undisturbed, since the character of the rock has much to do with the violence of the shock.* Besides this, there are in the Rocky Mountains many instances of poised bowlders, rock pillars, etc., in regions where it seems almost certain that there have been earthquake shocks of considerable violence in recent times.

While the evidence from geology leads us to believe that our Eastern States and, in a much greater degree, our Western States are at any time liable to be severely shaken, though without stating definitely whether they have been or not, the record of history in the two hundred and fifty years more or less of occupancy by Europeans gives us a much more hopeful view of the case. Even history, however, does not leave us entirely free from fear, and, if it did, it could not in this instance be thoroughly trustworthy, for the reason that two centuries and a half is but a short time upon which to base an opinion upon the behavior of nature.

Leaving out of consideration the Mexican and West Indian earthquake shocks, there have been in the region east of the Rockies only three really notable earthquakes in the last two hundred and fifty years,† and neither of these, unless it be that of New Madrid, was a really violent shock, although either would to-day produce much destruction if it were to occur in the neighborhood of our large cities.

The first of these shocks was the Newburg earthquake, which shook up the region about Boston in the early part of the 18th century, but apparently caused more alarm because of the remarkable bellowing noise which accompanied it than by reason of its destructiveness. While very little damage was done to life and property, it nevertheless served to convince the good Puritans of the instability of the earth and to give to the devout ministers of the Gospel very telling texts, which, however, were not very scientific, since the devil himself was supposed to be the cause of all the uproar and disturbance; and upon this premise the arguments for reform were based. It is probable that a repetition of this earthquake to-day would be very destructive, for the one or two story wooden and log houses of our forefathers are now replaced by high edifices of brick and very weak mortar.

In 1812 there occurred at New Madrid, in the Mississippi valley, an earthquake the effects of which are still to be seen in a large area of country which became transformed into a shallow lake and which is called in consequence the "Sunk County." Only a few frontiersmen occupied the region at the time, so that we have very little record of the actual condition of affairs; but enough was learned from these and by subsequent studies to show that the region was very badly shaken. The inhabitants state that the earth rose and fell in great waves, the trees rocked to and fro, and were entangled and broken, the earth opened and closed, and it is stated that the inhabitants were forced to fell trees and stand upon them to avoid being swallowed in the crevices. There was an incessant quaking of the ground for several successive months, and in this respect the earthquake is remarkable as an instance of this phenomenon which is common in volcanic regions, but rare far away from volcanoes.

The third earthquake, that of Charleston, in 1886, is too recent to call for any description. It is to be noted, however, that there have been other shocks in this region, notably in 1812; but neither of these is to be considered as a violent earthquake, although the character of the buildings in Charleston was such as to give to the last shock trail which tended to make the effect disastrous. The shock was sufficiently violent

* It is usually the case that the greatest destruction occurs on alluvial ground, probably chiefly because of its porosity and its ability to be fractured and compacted.

† The earthquakes of the Cordilleras and of California will not be considered, and it is of course understood that for a portion of the two centuries and a half we have had no record of events in the Mississippi valley.

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to throw an engine from the track, and to throw down many buildings and destroy some lives; but every year records more violent shocks than this one, in some parts of the earth.

What would happen in New York City if one of these shocks, or, perchance, a more severe one, should be repeated there? It is enough to fill one with alarm to think of the possibilities. Huge, top-heavy church steeples, mammoth buildings with projecting cornices, tumble-down structures, which even now, without the aid of an earth jarring, collapse and destroy human life—all of these stand ready to be used as death-dealing instruments whenever capricious nature causes a slight movement of the rock in that neighborhood. The occurrence of an earthquake in New York like that which occurred in the prefecture of Gifu, in Japan, a little over a year ago, or like that of Lisbon, in 1755, would remove the city from the face of the earth. This may never come—but, again, it may. Are we doing right in defying nature? We take our chances, and the chances are, it may be said, against any such dire calamity; but, if it should come, and it may, what then?

If one will examine photographs of the Charleston earthquake, he will notice that the effects of the shock were very different upon adjoining buildings. Some buildings were completely wrecked, while their neighbors were scarcely strained; and, if one will examine the reasons for this, he will find that in most cases it was a question of mortar. Moreover, the buildings which were oldest were apt to be least disturbed—our predecessors used better mortar than we do. The same thing is noticed in the recent earthquake in Japan. The modern pottery and tile buildings were badly wrecked and destroyed, but the old temple of Nagoya stood, and was only slightly damaged.

Our engineering schools instruct their students in the difference between good and bad mortar, and our architects and builders know full well which is good and which is bad; but the all-powerful dollar is the thing striven for, and immediate utility is sought after at the expense of strength and permanency. State and national laws are enacted and private rights set aside to prevent the landing of a cholera germ, which might be the means of killing a few thousand people—mostly undesirable citizens; but there is practically no protection from falling buildings. A building is condemned, it is repaired, perhaps by painting and the placing of a few timbers; it collapses, an investigation follows, some one is to blame, but no one is found guilty, and so we are any of us liable to walk into a death trap. The man who first built the building is to blame; those who allow it to remain standing are almost as much to blame; but they reap the reward; some innocent persons suffer loss of life or limb. An earthquake shock would effectually raze these to the ground, and with an effect, reckoned in loss of life, compared with which a plague of cholera would be but nothing. I sincerely trust that we shall not have the lesson of proper and sensible methods of construction forced upon us in this disastrous manner; but we may.

The Schuylkill Valley.

At the recent meeting of the American Institute of Mining Engineers, at Reading, Pa., the president, Mr. John Birkinbine, took for his subject "The Industrial Progress of the Schuylkill Valley Region." Iron was first made in Pennsylvania in 1692, and the first successful iron enterprises were the Bloomery forge, 1716, and the Coalbrookdale blast furnace, 1720. In 1731 pig iron was sold at the latter furnace for £5 10s. per ton. From 1720 to 1740 a number of furnaces and forges were established in this district. The Warwick furnace was built in 1738, and remained active for 130 years. It was 32 ft. high, with a bosh 7½ ft. to 9 ft. diameter, blown with wooden bellows, and producing twenty-five to thirty or even forty tons of iron per week.

The present Warwick furnace—referred to later on—is 70 ft. high, 16 ft. diameter at the bosh, and averages 750 tons—maximum, 875 tons—of pig iron per week. With the remodeled furnace, powerful blowing engines, and new hot blast stoves, still better results are anticipated. None of the present industries are over fifty years old. The Pottstown Iron Co.'s works have grown from a small plant, employing 200 men, to one which now requires 2,000 men to operate its blast furnaces, steel works, rolling mills, etc., and turns out about 1,000 tons of product daily. These works were pioneers in commercially manufacturing fertilizers from slag. At Birdsboro a forge was established in 1740, and one of the first rolling mills in the country, and a nail factory, were in operation before the revolutionary war. In this neighborhood is the Cornwall charcoal furnace, 150 years old, the oldest now standing in the country, and near it is the Cornwall bed of soft, magnetic iron ore, from which 12,000,000 tons have been taken out. Near Pottsville was the furnace which first introduced the hot blast, and first successfully produced anthracite pig iron, and also the first American blast furnace in continual operation on anthracite fuel alone for three months.

The practicability of the use of anthracite coal in place of charcoal was proved in 1840 by Mr. David Thomas, the first president of the Institute, and the use of bituminous coal naturally followed. Anthracite coal was not shipped in any quantity until 1820, but the output of the Pennsylvania anthracite fields has now grown to exceed 40,000,000 gross tons per annum, for the mining of which $40,000,000 per year are paid in wages. The Pottsville shaft is 1,586 ft. deep, but this is kept in reserve, and no mining is done. The collieries now at work go as deep as 900 ft., and some produce 375,000 to 450,000 tons of coal per annum, having coal breakers which cost $75,000 each, and can handle 2,000 tons of coal. There are nine veins of coal, six of which are persistent, and have a thickness of 6 ft. to 33 ft., while the Mammoth vein occasionally exceeds 100 ft. in thickness. The resources of the Schuylkill Valley appear to be far from exhaustion. The annual production approximates 15,000,000 tons of anthracite coal, 600,000 tons of pig metal, and an equal amount of rolled iron and steel, much of which is converted into bridges, roofs, machinery, stoves, hardware, etc., and to these must be added the glass, paper, textile, and other industries, which render this one of the most important mining, manufacturing and industrial districts of the United States.

Statistics of the Running of a Watch.

Watches were formerly highly esteemed, and the greatest care was taken of them, but since they have become cheap, they are ruthlessly submitted to all causes of destruction (falls, dust, sudden changes of temperature, magnetism, etc.), and the owners are sometimes astonished at their refusal to run. Yet, as compared with any sort of a machine, an ordinary watch is a marvel. A few figures will make this understood. The spring actuates the barrel, the motion of which is transmitted through three wheels to the escapement, whose wheel strikes the anchor or the cylinder of the balance wheel at an average rate of 8,000 blows per hour (with differences of from 3,000 to 4,000, according to the system). Another gearing retards the motion transmitted to the hour hand in the ratio of 12 to 1. All the motions of the watch are discontinuous, and are effected in little equal jumps, the number of which exceeds two hundred million a year in certain watches. Those who are careful about preserving their watches have them cleaned every two years, that is to say, after 300 or 400 million impacts. At the end of twenty years a well made watch, and one that has not been destroyed prematurely, must undergo a change of a few pinions, but it is after several thousand million of the little jumps that we have spoken of, and after the escapement wheel has made tens of millions of revolutions. If to this we add complications such as the chronograph and watches giving the date and repeating the minutes, we remain astounded at their possibility. As for the distance traveled by the exterior of the balance, that is so unexpected that all our readers, we think, will admit the result only after having verified the calculation.

The balance of a 19 line watch measures on an average 0·66 of an inch in diameter upon the regulating screws. It makes 5 oscillations of one revolution and a half per second, say a travel of 15·5 inches per second, 20 miles per day and 7,500 miles per year in round numbers. Now watches that give the perpetual date are provided with a wheel that makes one revolution in four years. During this time the balance will have made the tour of the world. The small amount of power utilized for the running of a watch is no less extraordinary. According to the *Journal Suisse d'Horlogerie*, a watch spring weighing 30 grains is capable of running a watch forty hours. At the rate of 72·5 foot pounds available per pound of steel we shall have 0·29 foot pound for forty hours, or 0·00725 foot pound per hour. One horse power develops in one hour 543·75×3,600=1,957,500 f. p. A watch requires then,

$$\frac{0{\cdot}00725}{1{,}957{,}500} = \frac{7{\cdot}25}{1{,}957{,}500{,}000} \text{ f. p.}$$

in other words, a one horse power would suffice to run 270 million watches, or probably all the watches that exist on the globe. And, again, it is the escapement that consumes the greater part of such power. In fact, the escapement wheel sets itself rapidly in motion and undergoes an abrupt stoppage, which, according to the principle enunciated by Lazare Carnot, always occasions a loss of live power, or, as we would say to-day, a waste of energy. The resistance of the air to the motion of the balance and the coiling and uncoiling of the hair spring also occasion losses. What remains for the gearing and the arbors? Not much, assuredly. And all this mechanism, placed under various conditions of position, temperature and air pressure, manages to run at less than a second variation, about, per day.—*La Nature.*

IN August last the planet Venus was visible in the day time at San Diego, Cal. A California correspondent writes that he was one of many who witnessed the phenomenon, and says it was especially noticeable, as the planet could be seen with the sun almost shining in one's eyes.

Correspondence.

Another Brooks Comet.

To the Editor of the Scientific American:

On the morning of November 19 I discovered a new comet, in the constellation Virgo. The discovery position was right ascension, 12 hours 56 minutes 40 seconds; declination, north, 12° 59′. Motion, slowly northeast. The comet can be seen in telescopes of moderate size. WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y., Nov. 25, 1892.

Fog Lighting in London.

A good deal of silly talk has been heard of late from various quarters respecting the imminent decadence of the metropolitan gas industry; and some of the trade union leaders in particular have tried to make out that there is less employment to be had in gasworks than heretofore, on account of the imaginary falling off in the consumption of gas. All this airy nonsense disappears at the first touch of such a reality as that which recent meteorological influences have put in evidence. A downright dingy, dirty, wretched week of weather, such as we seem to get in London more frequently than ever, makes everybody fly to gas for light and comfort. Not only in the streets, but in the railway stations, when it becomes a question of carrying on business under the worst conditions, the "light of luxury" is left alone; and the reliable friend of the townsman is brought forward as though nothing else had ever been heard of. Although the experience is not a very enjoyable one, it is instructive to make a pilgrimage through a mile or two of the most frequented of the London thoroughfares when at midday it is impossible to see across the street. Here and there a huge industrial or commercial establishment—a printing house or factory for the manufacture of fancy goods—looms grandly through the thickened atmosphere, radiating light from roof to basement.

The best effect, however, is produced by the shops wherein high power recuperative lamps are hung over the doors, or along the front, or where clustered Argands or flat-flame burners strongly illuminate the goods exposed in the windows. These places irradiate the neighborhood in a style unapproachable by other means. As for the wider street crossings and the railway yards, one longs, in the absence of a sufficiency of high-power gas lamps, for a few good "flares" of the Lucigen type. The sparse electric arcs are utterly ineffective at such times. They seem lost in the upper air; and a curious effect is produced by the unusual prominence of the glowing carbon spark, which gives the most powerful arc the aspect of a rather poor incandescent lamp. As to the latter, their lower tone helps them to penetrate the air that enwraps them like a dirty blanket; but the pleasant fiction about a nominal 8-candle lamp being to all intents and purposes equal to a flat-flame gas burner is utterly demolished by the inconsiderate atmosphere. All these are old truths; but it is just as well to keep them in the front when occasion serves.—*Jour. of Gas Lighting.*

Railroads of the World.

The Census Office has issued a bulletin giving statistics of the railway mileage of the world in 1890. It shows that out of a total railway mileage for the world of 370,281 miles the United States have no less than 163,597 miles, or 44·18 per cent of the whole, and that the railway mileage of the United States exceeds by 3,493 miles the entire mileage of the Old World, Europe's 136,865 miles, Asia's 18,793 miles, and Africa's 3,992 miles making an aggregate of but 159,655 miles. It is interesting to note the astonishing growth of the railway mileage of the United States from the census year of 1830, when there were less than 40 miles of railways, up to 1890. In 1840 the figures were 2,755 miles; in 1850 they had risen to 8,571 miles; in 1860 the total had swelled to 28,919 miles. The census of 1870 showed the mileage to be 49,168 miles; that of 1880 placed the figues at 87,724 miles; while the eleventh census figures give the astonishing total of 163,597 miles.

The following shows the mileage of the world by countries: Germany, 25,969 miles; Austria and Hungary, including Bosnia, 16,467; Great Britain and Ireland, 19,939; France, 22,586; Russia, including Finland, 18,728; Italy, 8,117; Belgium, 3,218; Netherlands, 1,887; Switzerland, 1,929; Spain, 6,127; Portugal, 1,280; Denmark, 1,223; Norway, 971; Sweden, 4,915; Roumania, 1,580; Servia, 327; Greece, 440; Turkey in Europe, Bulgaria, and Roumelia, 1,097; Malta, Jersey, and Man, 68; United States, 163,597; British America, (Canada), 13,322; Newfoundland, 115; Central America (Guatemala, Salvador, Costa Rica, Nicaragua, and Honduras), 559; Mexico, 5,344; United States of Colombia, 231; Cuba, 1,056; Venezuela, 441; Republic of San Domingo (eastern part of the island of Hayti), 71; Puerto Rico, 11; Brazil, 5,779; Argentine Republic, 5,129; Paraguay, 149; Uruguay, 470; Chile, 1,926; Peru, 994; Bolivia, 106; Ecuador, 167; British Guiana, 22; Asia, 18,798, of which British India supplied 15,837; Japan, 907; China proper, 124; Africa, 3,992; Australia, 11,137.

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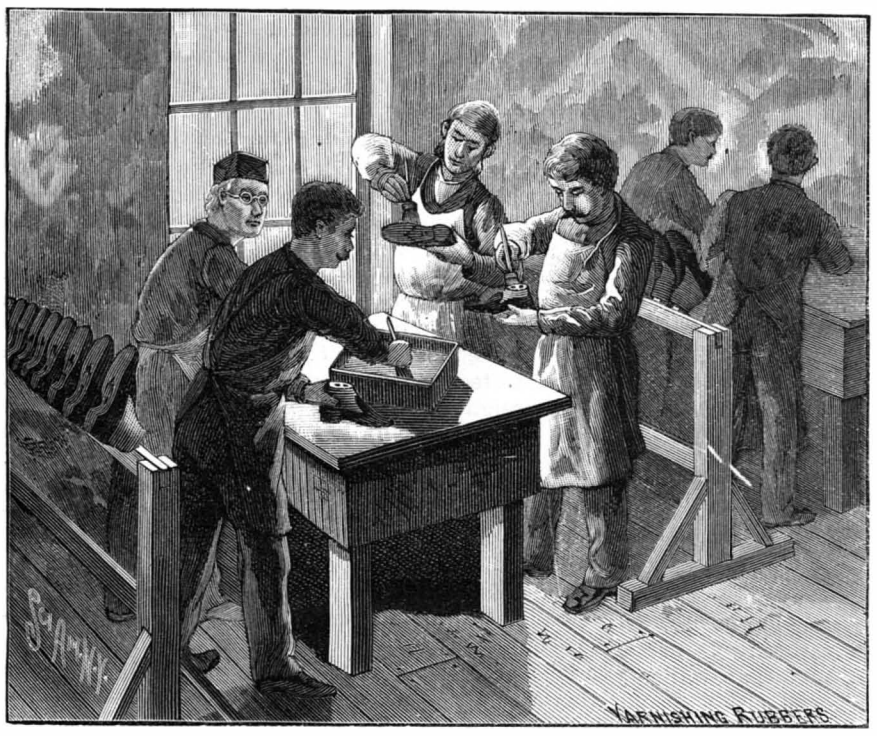
MANUFACTURE OF RUBBER SHOES.

BY B. G. UNDERWOOD.

The many good qualities of caoutchouc, or India rubber, have been known for a great many years. In 1791, Samuel Peal obtained a patent in England for waterproofing fabrics by means of this gum dissolved in spirits of turpentine, though this does not seem to have led to any practical results. In 1813 a patent was issued in this country to J. F. Hummel, of Philadelphia, for a varnish of gum elastic. In 1831, George H. Richards, of Washington, D. C., received a patent for a fluid caoutchouc and soon afterward Edwin M. Chaffee, of Roxbury, Mass., and others established the Roxbury India Rubber Company, which was chartered in 1833 and was the first company organized in the United States to manufacture caoutchouc into waterproof clothing.



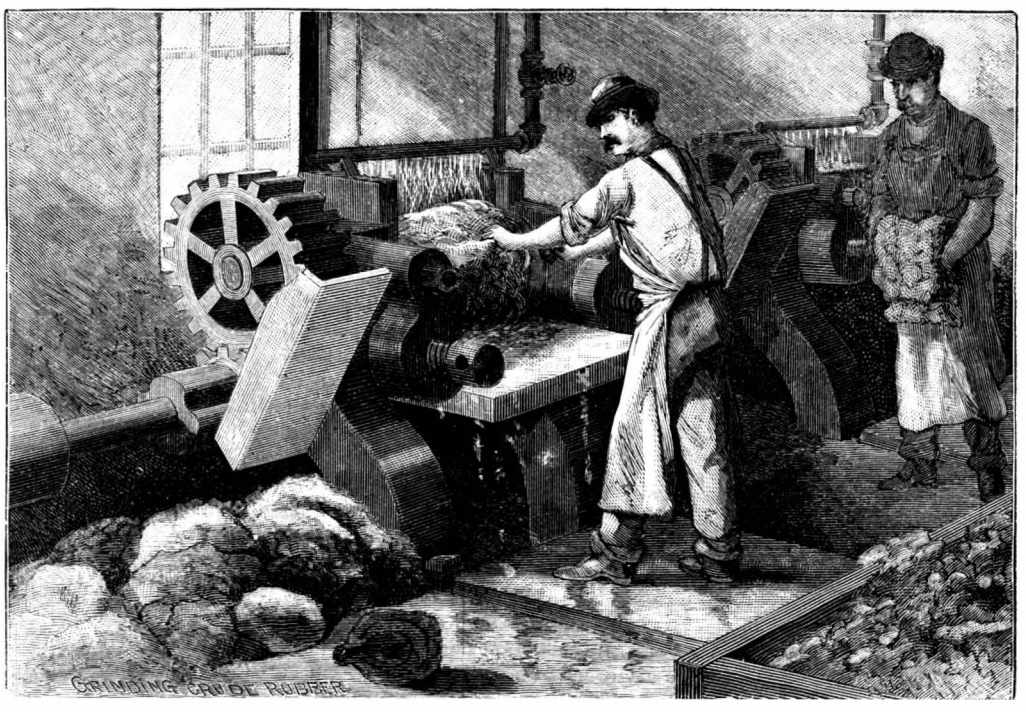
Charles Goodyear, in 1835, after devoting much time to experiments, took out his first patent. In 1839 he took out a patent for the sulphuring process, which would have been of little value without the subsequent improvements which he made. The sulphur imparted an offensive odor and did not prevent the rubber from hardening in cold weather. Experiments convinced him that the application of considerable heat would cause the sulphured article to be pliant in cold weather and to increase its elasticity in all temperatures, and the result was his patent issued in June, 1844, which was reissued in 1849, extended in 1858, and again reissued in 1860.

The history of the Boston Rubber Shoe Company, whose plant furnishes us with the accompanying illustrations, is a remarkable one. The company was organized in 1853 and Elisha S. Converse was chosen treasurer and manager, a position which he has occupied ever since; and to his foresight and ability the company owes its present position, having the largest plant for the manufacture of rubber boots and shoes in the world. The two factories in Malden and Melrose give employment to 3,000 people and turn out 45,000 pairs daily. The Malden factory was burned in 1875, rebuilt in 1876, and in 1882 the Melrose factory was constructed. The number of employes in each is about the same, but in the Malden factory, which is known as factory No. 1, all of the odd sizes are made, the machine shops are located, new designs are perfected, steel rolls engraved and all the miscellaneous work done.

The orders received by this company from its customers run into very large figures. Orders for 15,000 cases of goods are common, and to-day they have several orders on their books for 25,000 cases and one order for 30,000 cases. When it is understood that a freight car will hold 500 cases and a case averages twenty pairs of rubbers, the magnitude of these orders will be appreciated, and they have shipped in single orders at one time twenty freight cars to one party in San Francisco and one to Minneapolis, and filled one order recently which filled thirty-two freight cars and contained 320,000 pairs of rubber goods.

There is enough interesting machinery used in the preparation and manufacture of rubber into boots and shoes to fill this entire paper, and it has been difficult for our artist, in the limited space at his disposal, to select material, but we think the illustrations will fairly represent some of the many processes employed in the manufacture of these articles.

The crude rubber as received from Para, which furnishes the finest grades, is packed in large wooden boxes $4 \times 2 \times 1\frac{1}{2}$ feet, containing about 350 pounds each, and the second grade in boxes twice the size, containing about 700 pounds each. The boxes are filled with crude rubber, the pieces being in every possible shape, weighing from 1 to 75 pounds. Before going to the washing machine, or cracker, which is shown in the cut at the top of the page, the original pieces are cut by a circular knife to sizes suitable for the cracking machine. It passes a number of times through these washers, water and steam being sprayed in the rubber during the operation, until it is sheeted in sheets of about 1-16 of an inch thick, first passing through a machine with corrugated rolls, and finally through one with smooth rolls, which leaves the sheet smoother and thinner.



The grinding machines have a capacity of about 1,000 pounds a day, and will handle from 10,000 to 14,000 pounds of fine Para rubber a day, or from 8,000 to 10,000 pounds of the coarser grades.

From the grinding room the sheets of rubber are taken to the mixing room, where they are mixed with lamp black, whiting, sulphur, and other ingredients. Passing through a number of rolls many times, which are heated it leaves this department in sheets about ½ inch thick. This process is clearly shown at the top of our first page. From this room it passes through the refining machines, which turn it out less than 1-32 of an inch in thickness, or the right thickness for the uppers of rubbers so largely used.

The cloth-calendering machine, which is shown on this page, backs the large roll of cloth, which is seen in the engraving, with rubber. This material is used for lining rubber shoes. The machine has great power, and turns out about ten yards a minute from a roll which is 1¼ yards in width.

For rolling sheet rubber for boot vamps, it is necessary to run in several thicknesses. This work is done in another rolling machine, which we have not space to show, and the finished rubber sheets are carried by an endless belt into the story above. The thin sheets of rubber are stamped by circular steel rolls, on which the pattern is engraved so as to mark the sheets for cutting uppers, which is done in another room.

Rubber boots and shoes could not be made without piping, which is used to hold the different pieces in place. This is cut in strips 18 inches long by 1 inch in width, and 42 of these strips are placed so as to lap over each other, making a width of 10 inches, by an automatic machine. There is nothing that piping will not hold, and we meet this indispensable necessity at all stages of rubber boot and shoe making.

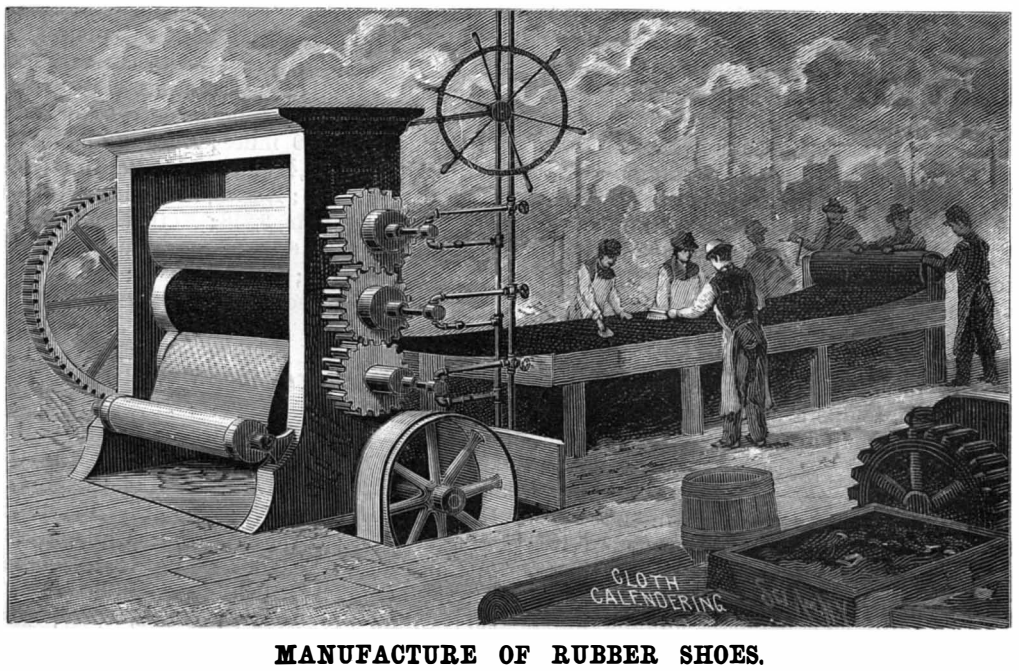
The heel-cutting machine shown on front page takes in solid rubber sheets about one yard square, one inch in thickness, weighing about 90 pounds to the sheet, and from each sheet can be cut from 100 to 230 pairs of heels. The heel-pressing machine shown on front page works by hydraulic pressure of 1,000 pounds to square inch and holds 25 heels. They are subjected to this pressure from 7 to 8 minutes, with from 85 to 90 pounds of steam, and leave the press with the name and number stamped on the bottom, and so nearly finished that only a little trimming is needed about the upper edge before being attached to rubber boots.

The rubber sheets for cutting soles (see first page) vary from ⅛ to ⅓ of an inch in thickness and are a little over a yard in length. It will be noticed that piles of thin wooden boards are shown in nearly every illustration. This is necessary, as the rubber sheets must be kept apart, as they adhere to each other if brought in contact. The soles are nearly all cut by hand. This requires skilled labor, as they are all beveled. A man will cut from 900 to 1,000 pairs a day.

Sole rolling is done by a machine shown on front page. This stamps, at the same time, the pattern shown in the bottom of rubbers. The strips each contain soles for ten rubbers, and are placed on thin wooden boards, and are then carried on trucks to the sole-cutting room. There are about thirty different patterns, and sixteen sizes are made from each pattern; but the same pattern can be used for all the different sizes. The uppers are cut by hand, with a die and mallet, as shown on front page. The average daily capacity of the cutters is from 600 to 700 pairs.

We have only space to show in our illustrations one branch of the actual manufacture of rubber boots and shoes, and we have selected that known as storm slippers, which have recently come into such general use. This slipper was designed by Mr. E. F. Bickford, general superintendent of the company, and the number made of this one brand in 1891 was 800,000 pairs. We also give the patterns used in making these slippers. The shoemakers, as the girls are called, make from thirty to thirty-six pairs a day.

Iron cars for carrying rubber goods hold from 210 to 500 pairs, depending upon the size of the manufactured goods. The slats holding the rubbers after varnishing (see illustration) are placed in these cars, which are run into the vulcanizing ovens, where they remain in a temperature of from 140 to 180 degrees for a period of six to seven hours, when the goods are finished, and, after a thorough inspection, are carefully boxed and



MANUFACTURE OF RUBBER SHOES.

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packed, and can be purchased not only in every village and city of this country, but in most of the cities of Europe.

THE SOUTHERN COTTON HARVESTER.

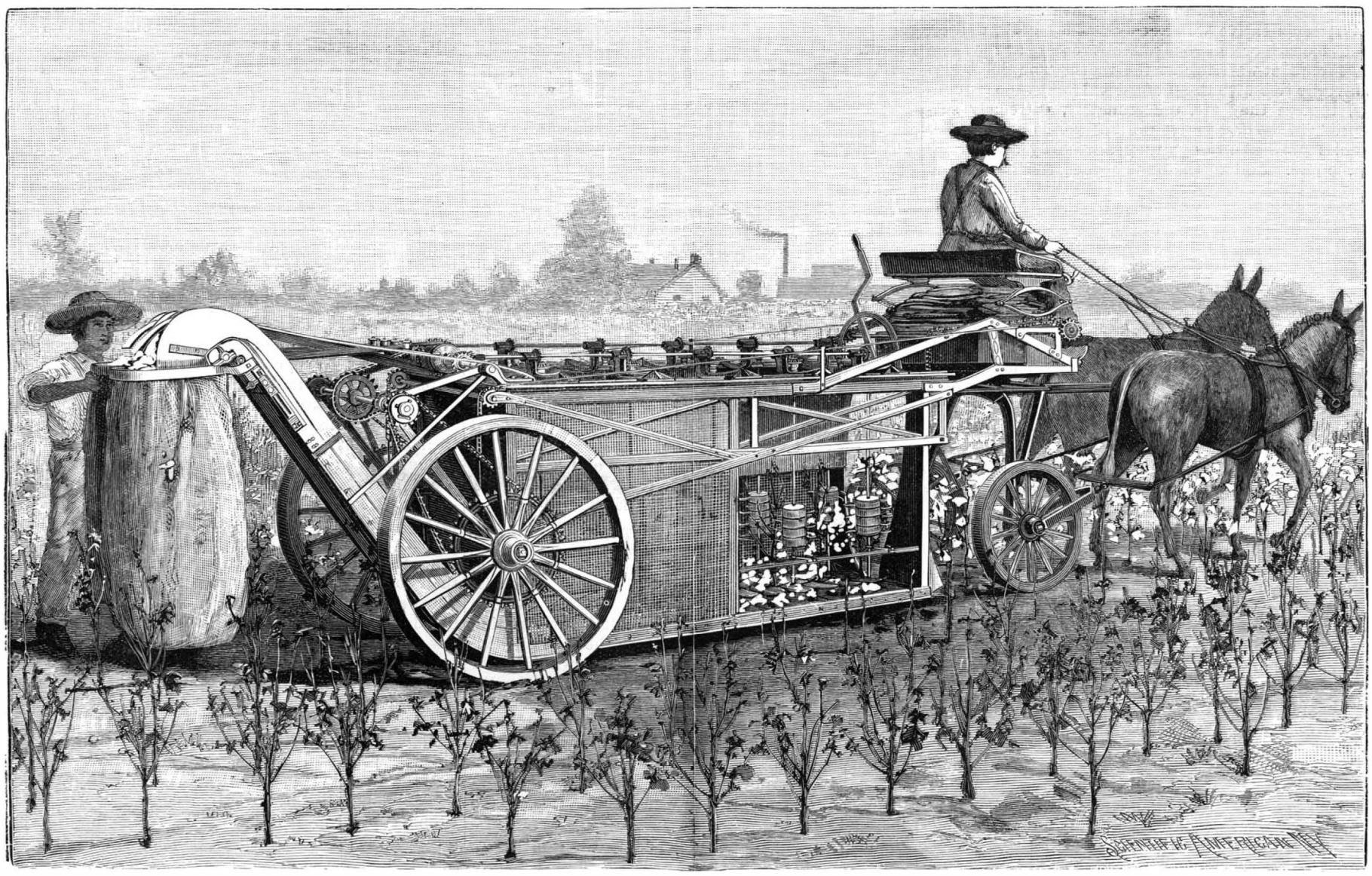
One of the subjects of invention which seem to have baffled inventors for many years is a practical cotton harvester. The cotton crop is a peculiar one, presenting the necessity of dealing with the delicate fiber and at the same time with twigs, and green and ripe bolls. In harvesting cotton by hand labor, the harvest time is subdivided into three different periods, the first of the crop being gathered from the lower portions of the plant, the second part of the crop being gathered from the central portion, and the third part from the upper portion of the plant. It will thus be seen that the problem is a complicated one, and it is not strange that there should be many failures before cotton harvesting by machinery becomes a commercial success.

To a large extent, cotton planters in the South have been hampered by the difficulty in obtaining labor at the right time, and, as a result, serious losses have followed; but at length a machine has been perfected which reduces cotton harvesting to a certainty. To run this machine, two men and a single team are required. It will harvest from 5,000 to 6,000 pounds of cotton per day at a cost of $3 to $4, as against forty men picking not over 150 pounds each per day at a cost of $30. This machine, which is the subject of our engraving, is so simple as to hardly require an explanation. A general description will render its construction and operation clear.

The machine consists of a frame suspended on ordinary wagon gear and inclosed in wire cloth. Within the frame are journaled two series of vertical shafts, upon which are placed beaters having spring arms. Through the bottom of the frame extends a slot, through which the stalks of the cotton plants pass. In the bottom of the frame are arranged conveyors which carry the cotton beaten from the plant rearwardly and upwardly, and deliver it to bags attached to the elevators at the rear of the machine. The slot through which the stalks pass is furnished with series of swinging plates which open only as the stalks pass, thereby keeping the bottom of the machine closed and retaining all of the cotton detached from the plants. The beaters are made adjustable, so that they can be placed at a suitable height to engage the ripe bolls as the machine passes along. One of these machines has been in operation this season in Alabama, yielding the results we have described above.

The New York office of the Southern Cotton Harvesting Company is located at 319 Broadway.

Mr. Isaac Blum is president of the company, and we are informed that Mr. L. R. Turner has been largely instrumental in bringing the machine to perfection.



A NEW COTTON HARVESTER.

Stick to a Legitimate Business.

Well directed energy and enterprise are the life of American progress, and safety lies in sticking to a legitimate business. No man—manufacturer, trader, or banker—has any moral right to be so energetic and enterprising as to take from his legitimate business the capital which it requires to meet an emergency.

Apologies are sometimes made for firms who have failed, by recurring to the important experiments they have aided, and the unnumbered fields of enterprise where they have freely scattered their money. We are told that individual losses sustained by those failures will be as nothing compared with the benefits conferred on the community by their liberality in contributing to every public work. There is little force in such reasoning. A man's relations to a creditor are vastly different from his relations to what is called the public. The demands of the one are definite, the claims of the other are just what the ambition of the man may make them.

The histories of honorably successful business men unite to exalt the importance of sticking to a legitimate business; and it is most instructive to see that, in the greater portion of the failures, the real cause of disaster was the branching out beyond a legitimate business, in the taking hold of this and that tempting offer, and, for the sake of some great gain, venturing where they did not know the ground, and could not foresee the pitfall.

Let Us Have Good Roads.

Colonel Albert A. Pope deserves the thanks of the present generation, and will undoubtedly receive those of posterity, for his untiring efforts in favor of the improvement of American roads. We need not repeat what has been often said here and elsewhere, that the crying need of our country is decent ordinary roads, over which the farmer can haul his produce to market and the city merchant can distribute his goods to his circle of rural or suburban customers with economy, speed, and convenience. As with all inveterate evils, it is hard for us, accustomed to the old system, to realize the difference which a better one would make in our condition. The number of horses and mules owned in the United States is about sixteen million, and the cost of keeping them is probably not less than two hundred million dollars a year. It is found, by hundreds of experiments, that one horse, working all day, and day after day, can do as much work on a good macadamized road as eight horses can on a road covered with gravel from four to six inches deep, as is usually the case with suburban roads after the annual repairing. Now, bad as are these repaired suburban roads, every person of experience will acknowledge that the labor of pulling a vehicle over them is as nothing in comparison with that involved in wallowing through a Virginia, or Ohio, or Indiana, or Kansas highway after a rain, or when the frost is coming out of the ground. Indeed, it is not necessary to make any invidious distinction in favor of any of the States, for the mud of Connecticut or New York, or the sand of Southern Massachusetts or New Jersey, have little to fear, as regards capacity for retarding locomotion, by comparison with the loam of the Mississippi Valley.—*Amer. Architect.*

A Trip to a Fixed Star.

Dr. David Gill, lecturing recently on "Fixed Stars," hit upon the following adroit method to illustrate the distance to Centauri. The doctor said, as reported in the Boston *Globe:*

"We shall suppose that some wealthy directors, for want of outlet for their energy and capital, construct a railway to Centauri. We shall neglect, for the present, the engineering difficulties—a mere detail—and suppose them overcome and the railway open for traffic. We shall go further, and suppose that the directors have found the construction of such a railway to have been peculiarly easy, and that the proprietors of interstellar space had not been exorbitant in their terms for right of way. Therefore, with a view to encourage traffic, the directors had made the fare exceedingly moderate, viz., first-class at two cents per 100 miles. Desiring to take advantage of these facilities, a gentleman, by way of providing himself with small change for the journey, buys up the national debt of England and a few other countries, and, presenting himself at the office, demands a first-class single to Centauri. For this he tenders in payment the scrip of the national debt of England, which just covers the cost of his ticket; but at this time the national debt from little wars had been run up from $3,500,000,000 to $5,500,000,000. Having taken his seat, it occurred to him to ask: 'At what rate do you travel?' 'Sixty miles an hour, sir, including stoppages,' is the answer. 'Then when shall we reach Centauri?' 'In 48,663,000 years, sir.'"

Manufacture of Cod Liver Oil.

The process of manufacturing cod liver oil at Portugal Cove, Newfoundland, is as follows: It requires, as a rule, 2½ gallons of liver to produce a gallon of oil. The livers are first carefully washed, and must then be "cooked" at once. For this process they are first put into a large tin boiler, which is plunged into a large iron boiler filled with hot water, the water not being allowed to touch the livers, which are thus gently steamed till a quantity of oil is floating on the surface. This is dipped out and filtered through bags of moleskin. The last filtration leaves the oil perfectly transparent, and without any unpleasant taste or smell. The oil is exported in 60 gallon casks.

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Trees in French Cities.

One of the chief beauties of the larger French cities, and second only to their magnificent edifices and monuments, are the trees.

The almost interminable vistas of chestnuts and acacias stretching along the broad and superbly paved avenues as far as the eye can reach, their bending branches almost touching one another in one endless arch of verdure, form not only a delightful perspective for the eye of resident and visitor alike, but serve to add beauty to cities already beautiful, and grace and symmetry to whatever might be harsh and forbidding.

It must not be presumed, however, that the existence of this veritable *rus in urbe* is the result of Nature's handiwork alone, for science and art have each in turn lent their aid in converting these great centers into tremendous forest gardens.

In short, the planting as well as the maintenance of the trees in French cities is an item of no little import in the annual budget prepared by the municipal council. Nor does this body look upon their preservation as a matter of less consequence than the repairing of its roadways or the lighting of its streets.

The climate and soil of France are not suited to the nurture and growth of every sort of tree; so that those chosen to line the avenues and boulevards of her cities must be selected with no little judgment.

Chestnuts thrive wondrously. They grow well on a not too rich or generous soil, but require at the same time frequent watering at the roots. The elm is also a favorite tree with the professional landscape gardeners, though they are, unfortunately, extremely susceptible to the destructive work of worms and insects. Maples grow slowly, but they are hardy and strong in the end. Add to these the acacia, the linden, the sycamore, the oak and the buttonwood, and the list of trees that live and thrive to advantage in the great Continental cities approaches completion.

France imports a great many of her fruit as well as shade trees, and the utmost precaution is taken as to where these shall be planted. Handfuls of earth from each and every spot where a tree is to be placed are carefully examined and analyzed. Upon ground rich and moist the trees from the United States grow best. A sandy soil is most favorable to resinous trunks, and so on in proportion to the teachings of science and arboriculture.

In squares and parks, though more especially along the principal thoroughfares, where the trees are planted about twenty feet apart, particular attention is given to the replacing of the dead or dying by healthy trees of the same species. In this way the line of perspective is never broken, nor is the vision repelled by the absence of a single trunk.

It would seem that a great many American cities, with their tremendous expanse of stone, brick and iron facades, might profit in the provision of shade and verdure by the example set by the cities of France. Sidewalk locomotion would be facilitated in the summer months by equal protection from the sun's rays on both sides of the street, while grace combined with genuine utility would serve to make the avenues as attractive, perhaps, as some of them are now forbidding.

Charles Kingsley, the great essayist, if I mistake not, is authority for the statement that verdure is just as essential to life as air itself, and that the kitchen garden of the laborer goes as much to add a touch of sunshine to his moral being as a bunch of roses to an invalid or the royal park to the Queen of England. The proof of the theory, which is a truer one than may at first appear, is in the witnessing of the crowds of poor that flock in summer time to any spot where grass and foliage exist. The French know this. They plant trees and lay out flower beds in every available corner within their cities' boundaries, while the benefit wrought thereby is too self-evident to demand interpretation.

HORACE G. KNOWLES.

United States Consulate, Bordeaux.

Iron Cinder Paint.

According to a memoir recently published by Mr. A. Sahlin, the cinder from puddling and excandescent iron furnaces can be converted into red paint of more or less body. The difficulty consists in reducing the cinder to a sufficiently fine powder; this is effected by means of a Blake crusher and a Cyclone pulverizer. The result of the operation would be to obtain 40 per cent of cinder in a state in which it can be put into fine paint, simply mixed with the ordinary oil mixture. The remaining 60 per cent can still be utilized as a coarser dark red paint, such as is used by the railway companies to preserve iron and steel from oxidizing. The treatment of the cinder is as follows: To 1,000 kilogs. of cinder crushed so as to enable it to pass through a sieve of 100 perforations to the square centimeter add 170 to 200 kilogs. of sulphuric acid of 66° B., the quantity of acid being in proportion to the lighter or darker shades of paint required. This mixture is worked first by hand, and then in a mechanical mixer; when the compound is thoroughly well mixed, it is put into a bin and there allowed to sweat. This chemical action manifests itself by a rise in temperature to 150° or 155°. The cinder consists principally of silicate of protoxide of iron, and the sulphuric acid eliminates the weak silicic acid, and a sulphate of protoxide of iron is formed. If this is calcined by the admission of air, it is converted into free sesquioxide of iron and sulphurous acid, which is extracted. The sweating lasts about four days, and then shows itself accompanied by exhalations of steam and a greenish discoloration of the powdered cinder. As soon as the reaction ceases each of the retorts of the calcination oven is filled with 220 kilogs. of the mass. The fire of the oven is fed with raw petroleum and compressed air. The retorts are raised to a cherry red heat, and the cinder during the calcination is removed in order to bring it as much as possible into contact with the air, so that the oxidation may be rapid. In three or four hours the dark and heavy cinder is converted into a red, light and somewhat doughy mass. If, after being analyzed with reactive paper, the acid is found to be completely volatilized, the cinder is allowed to get cold and is then pulverized in a Cyclone pulverizer. The only difference in the pulverization is that all it produces is now reduced to a powder sufficiently fine for the most delicate paint without leaving any residuum. The pulverizer reduces 360 kilogs. of calcined cinder per hour, and produces an excellent paint, the graduation of color of which rests with the operator, according to the quantity of sulphuric acid used in the preliminary operation.—*Colliery Guardian, from the Revista Minera.*

Rubber Varnish.

BY RALPH W. GRAY.

The varnish business, like the manufacture of rubber goods, is what is known as a secret business. There are in the United States about a hundred factories devoted to the manufacture of varnishes for furniture, carriage, and house work, with a few that devote their energies to manufacturing fine goods for artists. The use of varnish primarily is to give luster and durability to whatever it covers. In India rubber work the varnish is put on not alone to add durability, but to prevent the efflorescence of the sulphur. The bases of most varnishes are linseed oil and spirits of turpentine, but to those that are to be used on hard surfaces where a special luster is required, certain gums are added to give brilliancy and hardness. These gums are all of the resin families, the best being the hard fossil gums known as Kauri and Zanzibar gums. Certain varnishes are made from amber and a fine varnish is also made from celluloid. The more elastic a varnish is to be, the smaller the percentage of gum that is put into it. It follows, therefore, that in making rubber varnishes little or no gum is used.

As the bulk of rubber varnish is made of linseed oil, the secret of the business would naturally lie in its preparation. Many of the rubber factories have in connection with their plant a small brick building where is set a large caldron in which the oil is boiled. The operation is more or less attended with danger from fire, and it is therefore conducted at some distance from the main building. Considerable skill is acquired by the men who have charge of manufacturing the varnish, and as a rule those who are expert in this line do nothing else, and they receive good wages. This is just, as they incur considerable peril, many accidents having occurred in which the laborers have been badly injured.

The oil, after having been boiled to the proper consistency, either with or without the addition of a certain percentage of sulphur, Prussian blue, or resin, is taken in the light, clear pasty mass to the varnishing rooms, where it is thinned with spirits of turpentine and applied to the goods by means of brushes. There are no special tests for the quality of varnish, the ordinary way of examining it being to spread a thin film upon a piece of glass and to look through it toward the light, with a view of examining its clearness. Often the piece of glass is put in the sunlight, where the film will dry, and allowed to stand for a year. A first class varnish during this period should not shrink largely, nor should it crack. Linseed oil, however, is capable of absorbing a great quantity of oxygen, and unless carefully and skillfully boiled, will continue the process and crack.

Chemically, very little is known concerning the drying of linseed oil, but it is likely that the subject will be investigated thoroughly before long, with the means that are now within reach of the modern chemist. As linseed oil itself is a powerful oxidizer, those who purchase it for use in varnish are very particular in getting exactly the kind they need, and will not take chances on any brands, even if the price be considerably to their advantage. A piece of canvas spread with a linseed oil varnish that has not finished its oxidization will in the course of time be thoroughly destroyed, and the same effect will be produced upon a thin rubber surface. Hence it is quite important that this fluid be carefully tested before use. Some manufacturers make a varnish for rubber boots and shoes of the oil alone boiled to the proper consistency, while others add various driers and certain gums. It is a question if it would not be wise for these same manufacturers to examine carefully the various gums used in the regular varnishes to see if a certain percentage of them added to the linseed oil would not give an added brilliancy and a better durability. Of course this amount would naturally be very small, as Kauri, for instance, if added in too great proportions would have a tendency to crack when the goods are stretched.

In an experiment recently tried in a large rubber factory, ten per cent of Kauri gum was added to the varnish and found to be altogether too much; three per cent, however, gave a very pleasing result and seemed to have a luster that was not shown in the regular oil varnish. Varnish for rubber work, as a rule, is applied before the goods are heated; therefore, it has the chance of additional drying during that operation. Many of the goods when they come out of the heater are quite sticky, but a very little airing remedies this. To-day on almost all rubber goods that are put on the market there is found to be a very fair quality of oil varnish. A good grade of rubber when covered with varnish gives a far better result than a poorer grade, as the solvent often strikes through the shoddy or poor grade rubber and appears on the cloth itself, giving a stained effect and, furthermore, materially weakening the body of the rubber. In experimenting with varnishes a variety of solvents have been tried for the purpose of cutting the boiled oil. Of these any of the hydrocarbons will answer, because they are indifferent to atmospheric action and possess great solvent power. Oil of turpentine, however, is the best, and benzine the cheapest, of the various solvents in use.—*India Rubber World.*

Hot Water for Hemorrhage.

Dr. Julius Scheff, Jr., of Vienna, according to the current number of *Ash's Quarterly Circular*, recommends strongly the use of hot water for arresting hemorrhage after tooth extraction. "We are accustomed," he writes, "to stop hemorrhage by the method that has been used for generations, viz., by the direct application of cold water to the wound. Practitioners started with the idea that heat caused expansion of and induced increased bleeding from the vessels; but, on the other hand, cold caused contraction. In an ordinary case of extraction hemorrhage from the arteria dentalis, or from the gums and periosteum, soon ceases; but it frequently happens, even when the patient does not suffer from hemophilia, that there is difficulty in arresting the flow of blood." Dr. Scheff mentions three cases occurring in his practice in each of which there was a history of profuse hemorrhage after extractions. "I allowed one patient," he says, "to take a great quantity of cold water, and yet there appeared not the slightest diminution in the bleeding. I then took a glass syringe and continuously applied hot water, in drops, to the wound, from which the blood previously trickled without cessation. After a few seconds the bleeding diminished, a coagulum was formed, and the bleeding finally ceased. With the second patient, I used hot water at once, and the flow of blood was arrested. In the third case the wound had been bleeding freely for a long time; I plugged the alveolus with iodoform gauze, and on removing the plug the wound bled afresh. I then employed hot water; the hemorrhage ceased and did not recur." Dr. Scheff applies the hot water by means of a syringe, injecting it by drops into the socket of the tooth. The arrest of hemorrhage in surgical operations by the application of heat is a recognized resource, and it would therefore seem that this principle might with advantage be applied in cases of tooth extraction, especially as the mouth is able to bear a very high temperature without inconvenience. In fact, water so hot that it causes pain when the finger is inserted in it will in many cases be tolerated in the mouth.—*Lancet.*

A Three Thousand Foot Well.

An artesian well over 3,000 feet deep has recently been bored at Galveston, Texas. The water supply of that city is furnished by thirteen artesian wells varying in depth from 825 to 1,350 feet. The water obtained from this source, while being of good enough quality for fire and manufacturing purposes, is totally unfit for drinking and domestic uses. In view of this fact, it was decided that the city was justified in the investment of $75,000 in an attempt to obtain a good water supply, and therefore the artesian well was bored. The first 57 feet of the well consists of a 22 inch casing. Inside of this a 15 inch pipe extends to a depth of 870 feet. Next a 12 inch pipe extends to a depth of 1,200 feet. A 9 inch pipe was then inserted to a depth of 2,363 feet, and from this depth a 5 inch pipe extends to a depth of 3,070 feet 9 inches. No rock whatever was penetrated in reaching this depth and the water supply sought for was not obtained. Further work has been abandoned, and the hope of obtaining a flow of fresh water on the island given up. Wells will be sunk on the mainland fourteen miles from the city, and water brought across the bay by means of iron pipes. The estimated cost for this work is $800,000.

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JAY GOULD'S TOMB.

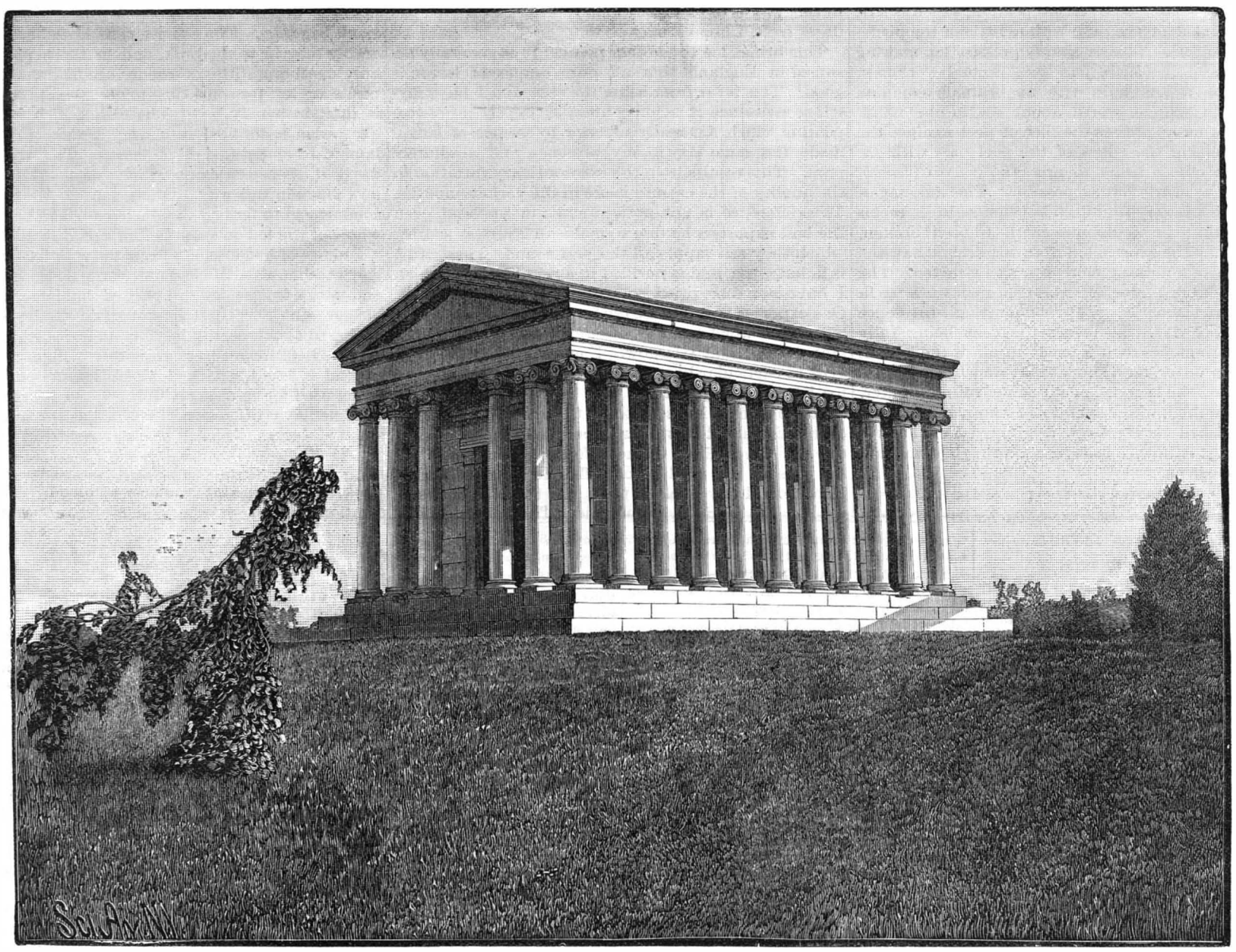
Perhaps the most noted financier and railway speculator of the past twenty-five years was Mr. Jay Gould, who died at his home in New York City, on December 2. The tomb erected for him several years since is shown in the accompanying illustration. It is copied after the famous *Maison Carre*, at Nimes, France, built some two thousand years ago, and perhaps the best preserved and most beautiful specimen of Grecian architecture in existence. Reared as it is upon a grass-covered knoll, where it commands a striking view of the surrounding country, the full beauty of the handsome marble structure, with its graceful Ionic columns, is appreciated by a beholder approaching it from any direction.

The design of the mausoleum was made by Mr. F. T. Fitz Mahony, and it cost $80,000. It is built throughout of Westerly granite. It is 33 feet long, 22 feet wide, and 20 feet high to the apex of the roof. The technical name of the building would be a Greek hexastyle, peripteral temple. It has six columns in front and eleven columns on each side in single rows. (This is counting the corner columns twice.) Three rows of steps run up to the temple on all sides and form its base. Between the columns and the walls of the temple is a considerable space. Columns and walls are bare, without the faintest attempt at ornamentation. In the center of the row of columns facing the south it looks as if a column had been removed to make a broad passageway. Facing this opening is the double door of the tomb. Each section of this door is 8 feet high and 2 feet wide, and weighs a ton. The doors are of heavy bronze, and the lower part is paneled and ornamented on the outside with two dragons' heads, a big iron ring swinging in the mouth of each dragon. The upper part of the doors is a fretwork of cherubs and vines, through the opening of which the interior of the crypt can be seen. The interior is 20 feet long, 7 feet wide, and 13 feet high. Its roof is a solid slab of granite, which weighs six tons. The border of the ceiling is paneled with egg and dart moulding. The floor is one plain marble slab. Along the sides of the interior are the catacombs. Of these there are twenty, ten on each side, in double rows. The rows are separated from each other by granite slabs. Each catacomb is 7½ feet long and 2½ feet wide. Between the lower end of the catacombs and the outside of the wall of the tomb is a thickness of 18 inches. The outer part of this thickness is, of course, granite, but facing the interior the walls are of light pink and cream-colored Tennessee marble, highly polished. The light enters the crypt through a stained glass window in the back. This window, which is 6 feet high and 3 feet wide, pictures a choir of angels. The roof of the mausoleum consists of granite slabs 32 feet long, each weighing fifteen tons, and so placed together that they overlap, making the roof waterproof. The whole temple weighs about 300 tons, and rests on a solid concrete foundation 8 feet thick.

Mr. Gould was born at Roxbury, Delaware County, N. Y., on May 27, 1836, his father being a small farmer, who kept a dairy of twenty cows. As a boy it was Jay Gould's duty to drive these cows and to help his sisters in milking them. He went barefooted and got thistles in his feet. He did not like it, and one day he told his father that he would like to go to school. He was then 14 years old, and his father was keeping a small store in the village. The elder Gould thought his son was too young to go to school, but the son gained his consent by persistence. He soon learned to write a good hand, and by writing up the books of the village blacksmith at night he earned enough to take him through a small select school. After that he got a clerkship in a country store. He made himself generally useful, sweeping it out and looking after business, working from 6 o'clock in the morning until 10 at night. He had a taste for mathematics, and got up at 3 o'clock in the morning to study until it was time to sweep out the store.

In a year or so he started out as a surveyor, and was employed to make a survey for a map of Ulster county. By odd pieces of luck through the summer that followed he made $500 out of his work as a surveyor. Afterward he made similar surveys and maps of Albany and Delaware counties, and by that time was worth $5,000. This he invested in the tanning business, his interest in which he afterward sold, and with all his capital in cash in his pocket bought the entire issue of the first mortgage bonds of the Rutland and Washington road to Troy. They were offered in the market at ten cents on the dollar, and the investment proved exceedingly profitable. It was the commencement with him of a life of dealing in railroad securities.

The history of Mr. Gould's railroad deals and financial enterprises would fill a volume. But they are merely incidents now, and can only be accepted as a part of the great movements which went to develop his characteristics and renown. He is perhaps most widely known by his connection with the Erie Railroad from 1868 to 1872, and his participation in the Black Friday gold excitement of September 24, 1869. He left a fortune estimated at about $75,000,000.



THE TOMB OF JAY GOULD, WOODLAWN CEMETERY, NEW YORK CITY.

97·3 Miles an Hour.

On Friday, November 18, engine 385 of the Central of New Jersey, the Vauclain four-cylinder compound, which several months ago made a record of 91 miles an hour, traveled a mile in 37 seconds, and two consecutive miles in 75 seconds, thus beating its own record as well as all others. This was done with a regular train of four cars, going east, between Fanwood, N. J., and Westfield, the grade being 32 feet per mile, descending. On the same trip a distance of five miles was traversed in 3 minutes 25 seconds, thus making the best record for that distance (87·8 miles an hour). This was between Somerton and Parkland, Pa., on the Reading, which is the same portion of the road where so much fast running has been done heretofore. The grade here is partly descending at 11 and at 37 feet per mile and partly level. This engine, No. 385, has four 78-inch driving wheels, weighs 62 tons, with 44⅕ tons on the drivers.—*Railroad Gazette.*

A Manual Training School in Louisville.

The city of Louisville, Kentucky, is to have a fully equipped manual training high school for whites, which will be an adjunct to the regular public schools, and will be controlled by the school board. The school and its equipment is to be the gift of Mr. A. V. Du Pont. In the prospectus some interesting details of the proposed work are given. All teachers in the manual training department are to be graduates of some reputable manual training school. No special trade will be taught in the school; neither will any articles be manufactured for sale. The shop building will be 132 feet long by 60 feet wide and the school building 122 feet long by 58 feet wide, each being three stories in height. The shops are to be run by independent electric motors, driven by a dynamo actuated by an 80-horse power Ball-Wood engine. The cost of the school will probably be $120,000.

Artificial Gum Arabic.

For the preparation of a so-called artificial gum arabic the *Rev. de Chem. Indust.*—through *Nouv. Remedes*, 1892, No. 13 supplem.—gives the following process: 10 kilogrammes linseed are boiled with 80 kilogrammes sulphuric acid and 100 liters of water for three or four hours. The liquid is then filtered and four times its volume of alcohol is added. The precipitate is collected, washed, and dried. The product is amorphous, colorless, insipid, and gives, with water, a thick mucilage.

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Essence of Lemon.*

BY ARTHUR A. BARRETT, MESSINA.

A few notes on the manufacture of essence of lemon will, I hope, be acceptable. In the first place, we all learn in England that essence of lemon is made with an ecuelle. Every book I can find says so, and on coming out here I was not a little surprised when I could not find a single one. The principle on which the extraction of the essence is carried on may be illustrated in this way: If you hold a piece of lemon peel up to the light and turn it inside out, a fine shower of mist will be seen to be forcibly ejected. This is not all oil, but a mixture of oil and water. Most people are unpleasantly acquainted with this phenomenon, though many have not actually seen it, for in peeling a lemon or orange with the fingers a little of the oil is often ejected into the eye, causing a considerable amount of pain. By turning the lemon peel inside out, almost the whole of the essence is removed from the peel, for each little globule of oil appears to be surrounded by water, and the liquid which remains adherent to the peel consists principally of water. As it is impossible to turn every piece of peel actually inside out, the following method is adopted:

One man takes a lemon in his hand, and with three rapid strokes with a large knife cuts off nearly all the peel in three slices. The central portion, which is left, consists of most of the pulp with a little of the peel—top and bottom. This is simply pressed for making lemon juice. The slices pass to a second workman, who sits on a low chair, with an ordinary common quality bath sponge, worth about 6d., in one hand. With the other he presses the slice of peel against the sponge, pressing the edges of the peel only with his fingers, the object being to press the convex piece of lemon peel as nearly flat as possible. The amount of pressure used is very slight, and at first sight it seems incredible that the oil globules can have been broken, but if you try the experiment of turning this exhausted peel inside out, nothing more can be extracted. The sponge is periodically squeezed. One man working in this way can extract about 1½ pounds (English) essence of lemon per day. To insure the cells being fully charged with moisture, it is usual to allow the lemons to stand in water for a short time; and I myself propose washing the lemons in a stream of running water. A second method, which, so far as I know, has not yet been published in England, originated in a clever fraud; but it is now, I believe, a thoroughly well understood business.

* Pharmaceutical Conference Proceedings.

A large trade has already been done here in lemon peel packed in brine, which has been exported for the manufacture of candied peel. Formerly the peels were sent in the natural state. They are now exported with about three-fourths of the essence removed. This is accomplished as follows: The lemon, instead of being cut as before described, is cut in two, lengthwise. Should there be any defect in the lemon, the workman contrives to cut it in such a way that, by removing a thin slice, the defect is cut away and two half lemons remain, both free from blemish, and only a thin piece wasted. The pulp and a little of the white is then cut out with a kind of spoon, care being taken not to rupture the oil vessels of the peel. Another workman then presses the half lemon in various directions against a sponge, and, though it is evident that the sponge process is rather at a disadvantage, he manages to extract about three-fourths of the total amount. The quantity of essence obtained in this way is considerable. As a consumer of candied peel, I should be inclined to condemn this process; though, as I have not seen the product and compared it with that made with the oil, I cannot say that it is inferior. It is stoutly maintained that if the essence were not removed it would be destroyed by the brine; and it is possible that there is some truth in this. As the essence made in this way is of superior quality, being made from the finest fruit, I hope it may be so.

This brings me to another point. It is generally assumed in England that all pure essence of lemon is good. This is far from being the case, and I have myself seen essence of lemon containing 15 per cent of turpentine which was really superior to essence of lemon made the same day in my presence, and absolutely pure. This results from the extraordinary variation in the quality of the essence made in the various months. This difference is not noticed much in England, even the best exporters having to make an average sample which they can supply all the year round. Turpentine is in large use, and is purified in a peculiar way, which I have not discovered, so as to have very little smell. One exporter is said to use ten tons per annum. Strange to say, the worst qualities of essence all go to London, Manchester, and Glasgow. English wholesale druggists in particular have an unenviable reputation here for buying low qualities. One Sicilian dealer thinks that the climate has something to do with the inability of Englishmen to distinguish between turpentine and essence. In addition to the difference depending upon the season, the product of different districts varies. Experienced buyers claim to be able to distinguish the district and village in which an essence has been made simply by smell and inspection.

Testing is carried out as follows: A sample is poured out into a tumbler and shaken up after placing the hand on top. Great attention is then paid to the duration and size of the bubbles and froth, the color is noted, and one smell is taken with the glass full and another after emptying it. Turpentine will certainly be detected in this way if over five per cent is present. Conducted in this way the purchase of essence of lemon is a matter requiring great judgment, and most of it being sold by peasants in small quantities, dealers cannot avoid sometimes buying a bad lot. If you make essence in your own works, the difficulties are not removed, only changed, the substitution of turpentine for essence by the workmen being frequent and so contrived as to be very difficult to detect. A favorite means of bringing turpentine into the works is by means of a bladder and tube, which is carried as near as possible to the bladder with which we all are provided. It is a very easy matter to empty this and attend to the calls of nature without exciting suspicion.

The following inferior qualities of essence of lemon are distinguished here:

Sacotte.—As soon as the essence is made it is allowed to deposit and the clear portion poured off. There remains a deposit in the bottom which is pressed in a small bag (sac). The essence thus obtained is considerably inferior to the bulk, and in those places where only small quantities of essence are made, and the deposits are left for some time to accumulate, the quality is extraordinarily bad. The cake which is left after expression is distilled in a very rough way, yielding lambicato or distilled oil of lemon. The whole of the distilled essence of lemon which was made in Sicily is now made in this way. Often enough the dregs have commenced to ferment, and in some cases have lost the whole of the lemon smell before being distilled.

Essence of lemon made from the rejected fruit from the warehouses.—In November and December a large amount of fruit is cut and packed, but instead of being at once sent abroad, it is stored in warehouses—fruit gathered at this season having qualities which enable it to be kept longer than any other. Before sending it abroad it is all repacked, the bad and doubtful fruit being used for essence making. This essence never has the fine flavor of its own, described as the smell of the wood (di legno), which is easily recognized.

ACCORDING to the last census there are 33,163 lawyers in the United States.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Thomas Courser, Lake City, Fla. This device has a knuckle with a coupling hook connected therewith, and is provided also with an auxiliary pivoted coupling hook, the latter being concealed when the main hook is in use. The knuckle is adapted to be employed in the same manner as such coupling devices are ordinarily used, while the auxiliary device may be used in connection with an opposing drawhead of the link and pin type, or it will be employed if any accident happens to the hook of the knuckle. The device is very simple and easily operated.

SNOW PLOW.—Patrick H. Craddock, Leadville, Col. This is a plow adapted to be secured to the pilot board of an engine, and its construction is such that it will automatically adjust itself vertically or laterally should an obstruction be met with on the track. By an operative mechanism connected with a storage reservoir of compressed air the engineer may elevate or lower the plow as desired. The plow consists of a clearing board or fender in the shape of two sides of a triangle, a cutter being centrally formed thereon and downwardly extending brushes are adapted to engage with the treads of the rails.

Mechanical.

BALANCE WHEEL.—Hiram Bouck and Julius H. Lovendale, Salt Lake City, Utah Ter. This is a wheel having radial and circumferential slots, holes extending through the wall of the wheel being connected with the slots, while screws and nuts may be entered in the holes and fastened in the several slots, whereby an adjustment may be readily made without removing the wheel from the shaft, the weight being adjusted to come more or less on one side of the center as desired.

SAW HANDLE ATTACHMENT.—Mitchell Pyper, New York City. Secured to the blade of a handsaw, immediately in front of the handle, are side-pieces forming abutments for a swinging square arm and bevel arms, whereby the saw may be conveniently used as a square and bevel. The swinging arm is pivoted and held by a thumb screw in any desired position, or may be detached at will, it being split longitudinally and held to straddle the saw blade.

Miscellaneous.

TREATING GOLD ORES.—Louis C. Daumas, Paris, France. This invention covers a process and apparatus for extracting gold from the ore. Protochloride of sulphur saturated with dry chlorine is used to dissolve gold at about 130° Centigrade, a double chloride of gold and sulphur being formed, while if the ore contains other metals they are transformed into oxide by roasting. The apparatus comprises a hopper-like receptacle surrounded by a steam coil, cross pipes extending through the receptacle and a filtering material being held in its lower portion.

SATURATING ARTICLES.—John A. Titzel, Glenshaw, Pa. This invention relates to an improved process of coating or saturating electric cables, to secure insulation, etc., and similarly treating hard and soft wood, terra cotta, etc., rendering the articles treated waterproof and preventing decay. The articles are first subjected to heat, to expand the air and fluids in the pores, and then immersed in a coating or saturating liquid, at a lower temperature, causing the liquid to be drawn into the pores of the heated article.

CENTRIFUGAL HONEY EXTRACTOR.—Charles W. Metcalf, Santa Paula, Cal. This is a device in which a rotating frame supports swinging holders or baskets, the centrifugal force of the frame causing the honey in the outer half of the combs to be ejected, the baskets then being reversed so that the comb holders change their position and the remainder of the honey is extracted, after which the comb-holding baskets can be readily removed and the holders refilled.

WINDOW WASHER.—David Mendelson, New York City. This is a simple and cheap apparatus with which a person may stand in a room and readily wash the outside of a window, the apparatus also facilitating the cleaning of the inside of the window, or the washing of a wall or ceiling. It consists of a telescopic main handle in hinged sections, fastening devices fixing the position of the sections, and a fixed jaw and a spring-pressed jaw being carried at the upper end of the handle. The jaws carry a wet swab at one end and a dry cloth at the other.

WINDOW SASH JACK.—Valentine Schirmer, New York City. This is an improvement on a former patented invention of the same inventor, providing a swinging support for sashes to facilitate cleaning them. The improved jack is light and cheap, and is adjustable to engage fixtures on different windows. The improvement was on exhibition at the late fair of the American Institute, New York City, its simple construction admitting of the window sashes being swung inwardly, either right or left, for the purpose of ventilation or cleaning. One swinging jack or skeleton bracket is sufficient for a building, its weight not exceeding four pounds.

COIN WRAPPER.—Ferdinand A. Jaekel, Memphis, Tenn. This improvement provides an oblong wrapper, properly marked for different values, and gummed at one end, and having also a central longitudinal line of perforations, in which coin may be neatly wrapped in specific amounts, and the package quickly separated into two equal portions, thus releasing the coin.

TWINE HOLDER.—Walter T. Hanson, Macon, Ga. This device has a base plate provided with a conical friction plug or spindle to enter the core of a ball of twine, in connection with a stationary angled arm having a suspension eye and guide eyes through which the cord is passed. The holder may be conveniently attached to an overhead support, to a counter, or be suspended in any position, holding the ball in such manner that the cord may be readily unwound.

BAG HOLDER.—Michael Fortin, Stillwater, Minn. This holder is provided with a frame, with a board held in inclined position on which the bag rests, and the holder, made of a single piece of wire bent to form connected loops engaging staples in the board, has curved arms at right angles to the loops, and having a sliding connection at their ends. The device is of simple and durable construction, self-tightening, and arranged to expand and open the bag when filling it.

LOCK FOR BAGS, PURSES, ETC.—Frederick R. Deck, Brooklyn, N. Y. This lock comprises two leaves placed back to back and having interlocking knuckles, the outer edges of the leaves being flanged and a pivot pin passing through the knuckles of both leaves, while a spring coiled on the pivot pin exerts tension upon the flanges of the leaves. The improvement is designed especially for double frames for double pockets, to lock both sections of the frame, both leaves being controlled by the same spindle and spring, but each leaf being operated independently.

CASH AND PARCEL CARRIER.—Samuel J. Besthoff, New York City. This improvement provides a car which may be placed upon a cable and carries its own driving mechanism, of a simple, durable, and inexpensive character. The car has a simple automatic locking device to hold it upon the cable, and the opening of the door of the cash compartment winds up the propelling mechanism. A parcel carrier, to transport goods with the cash, may or may not be used, as desired, in connection with the cash car.

PICK.—Kenneth J. Morrison and Michael McLellan, Stellarton, Canada. This patent is for a pick head having transverse slots to hold removable points, air passages leading from the slots into the eye, this improvement preventing the broken or "cracked" sound so often made in using picks having removable points.

DESIGN FOR BOOK REST AND UMBRELLA HOLDER.—Charles Pegler, Elgin, Ill. This is a combined book rest and cane and umbrella holder exhibiting a novel configuration of parts of bracket-like ends supporting a connecting board or shelf placed at an angle.

DRAWING INSTRUMENT.—Charles L. Davis, New York City. This is a draughtsman's compass designed for conveniently and rapidly drawing spiral lines, ovals, ellipses, and other curvilinear geometrical lines and figures. The improvement is included in a simple and durable construction, and the invention consists principally of a cord connected with one of the legs of the compass and adapted to wind on a drum mounted to rotate loosely on a spindle held on the other leg at the joint of both legs.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

METAL COLORING AND BRONZING. By Arthur H. Hiorns. London and New York: Macmillan & Co. 1892. Pp. xv, 328. Price $1.10.

The coloring of metals for the production of bronzes and other color effects is every day exciting more attention. The present work quite exhaustively treats of the different aspects of the question and how to treat different metals. Numerous formulæ are given.

A PRACTICAL TREATISE ON THE MANUFACTURE OF PERFUMERY. Comprising directions for making all kinds of perfumes, sachet powders, fumigating materials, dentifrices, cosmetics, etc. By Dr. C. Deite, assisted by Borchert, Eichbaum, E. Kugler and H. Toeffner. Translated by W. T. Brannt. Philadelphia: H. C. Baird & Co. 1892. 12mo. Pp. 358. Illustrated. Cloth. Price $3.

This work also contains a full account of the volatile oils, balsams, resins, and other materials used in the manufacture of perfumes. This book gives more details of manufacturing perfumes and toilet specialties on a commercial scale than any work on the subject which has come under our notice. The section relating to hair preparations is excellent and the chapter on cosmetics seems to be well up to date. Fruit ethers receive a fair share of attention. The number of receipts given in the book is large.

THE PRACTICAL BRASS AND IRON FOUNDER'S GUIDE. By James Larkin. Philadelphia: H. C. Baird & Co. 1892. 12mo. Pp. 394. Illustrated. Cloth. Price $2.50.

This is a new and enlarged edition of Larkin's well known work. The work has been revised and brought up to date, so as to include Mitis castings, steel castings, bell founding, bronze casting, chill casting, casting without a core, casting on other metals, casting upon inflammable materials, etc. Many sections of the old work have been entirely rewritten.

THE MANUFACTURE OF INK. Comprising the raw materials, and the preparation of writing, copying, and hektograph inks, ink extracts and powders, colored inks, solid inks, lithographic inks and crayons, etc. By Sigmund Lehner. Translated by W. T. Brannt. Philadelphia: H. C. Baird & Co. 1892. 12mo. Pp. 229. Illustrated. Cloth. Price $2.

The present work is founded on "Die Tinten-Fabrikation." A careful consideration is given to the raw materials, their selection and preparation. A large number of receipts is given, embracing nearly every kind of ink, and the author states that most of the receipts have been tested. Great attention is paid to

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ink specialtion and unusual forms and kinds of ink, such as safety ink, sympathetic ink, stamp inks, etc., while the important subject of printing ink is fully treated. Preserving agents for ink, the change of color in old documents and the methods of making faded writing ink legible come in for their full share of attention. This is the only treatise devoted entirely to the subject in print in the English language and is an important addition to technical literature.

THE HARDWOOD FINISHER. With rules and directions for finishing in natural colors and in antique, mahogany, cherry, birch, walnut, oak, ash, redwood, sycamore, pine, and all other domestic woods. Compiled and edited by Fred T. Hodgson. New York: The Industrial Publication Company. 1892. Pp. 94. Price $1.

This excellent work, with its very practical aspect, seems to cover a field that has been perhaps somewhat neglected. It is exceedingly practical, and with numerous formulæ for all kinds of stains and wood dyes, as well as finishes, is one that is to be found of value to many operatives.

LE CHAUFFAGE ET LES APPLICATIONS DE LA CHALEUR DANS L'INDUSTRIE ET L'ECONOMIE DOMESTIQUE. Par Julien Lefevre, Professeur Suppleant a l'Ecole de Medecine de Nantes, Professeur a l'Ecole des Sciences. Avec 188 figures intercalees dans le texte. Paris: Librairie J. B. Bailliere et Fils. 1893. Pp. 356.

The French aspect of this book is evident in the title, and the very large ground which it undertakes to cover is largely devoted to domestic heating, although other heating finds a place in it, and its numerous illustrations and excellent arrangement of pictures indicate good judgment on the part of the editor and publishers.

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SCIENTIFIC AMERICAN

BUILDING EDITION.

DECEMBER NUMBER.—(No. 86.)

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3. A colonial residence at Newton Highlands, Mass. Perspective view and floor plans. J. W. Beak, architect, Boston. A picturesque design.
4. A pretty cottage erected at Bridgeport, Conn., at a cost of $1,600. Floor plans, perspective, etc. A. M. Jenks, architect, Bridgeport, Conn.
5. A dwelling house erected at Warberth Park, Pa., at a cost of $4,478 complete. Mr. C. W. Macfarlane, architect, same place. A model design. Floor plans and perspective.
6. A "Queen Anne" cottage erected at St. David's, Pa., at a cost of $5,500 complete. A unique design. Perspective elevation and floor plans. F. L. & W. L. Price, architects, Philadelphia.
7. A residence in the "Colonial" style of architecture, erected at St. David's, Pa. Perspective view and floor plans. Cost complete $5.800. F. L. & W. L. Price, Philadelphia, architects.
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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(4604) O. C. asks: 1. What speed can be had with a 16 foot boat, 4 feet beam, using an engine 2½ inches bore, 3 inches stroke at about 60 pounds steam pressure? A. You should be able to run the boat 6 miles per hour. 2. What should be the diameter, pitch, and speed of the propeller to give best results? A. Propeller wheel should be 18 inches diameter, 36 inches pitch and make 250 turns per minute. 3. Should the propeller have two or three blades? A. A three-blade wheel is preferred. 4. What size boiler would be required and would the pipe boiler described in the SCIENTIFIC AMERICAN SUPPLEMENT be suitable? A. A vertical tubular boiler having 20 square feet of actual heating surface with shell 22 inches diameter by 36 inches in height, 33 tubes 1½ inch, will give all the steam required. The No. 3 pipe boiler described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 702, with 8 inches addition to the length, will make a safe boiler in which you carry 100 pounds steam pressure if desired, and large enough for the above speed.

(4605) R. T. McK. writes: Will you please answer me through your columns why it is that you can pump up a higher air pressure than your steam pressure by the gauge on a double acting air pump, the steam and air cylinders being of the same diameter, and the pistons operating on the same piston rod? A. The difference between the initial pressure in the steam cylinder and final pressure in the air-compressing cylinder is due to the difference in the mean pressure for the expansion of steam and the mean pressure for the compression of air. This is at once apparent to the eye when examining the indicator cards of equal sized steam and air compressing cylinders. The mean engine pressure for 70 pounds at ⅓ cut-off is theoretically 52 ponnds per square inch. The mean adiabatic pressure of the air cylinder for delivery of air at 100 pounds pressure is 50 pounds, while the mean isothermal pressure is but 30 pounds. The absorption of the heat of compression by water injection or jacket cooling brings the extremes to a mean, which, if ⅓ is absorbed, will make the mean pressure of the air cylinder about 43 pounds per square inch, with 9 pounds as the margin for compressor friction.

(4606) R. M. asks: 1. Is smoke a wet (watery) or dry vapor? A. Smoke is more or less mixed with the vapor of water, part of which is derived from the moisture in the fuel and another portion from the oxidation of the hydrogen forming part of the fuel. 2. What weight would a ball 100 pounds indicate on a balance if dropped from a height of 100 feet? A. The weight multiplied by the fall is equal to 10,000 foot pounds. If the balance arrests the fall of the ball in 6 inches after contact, the average impact force is 20,000 pounds. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 862, on impact or the force of percussion.

(4607) G. C. W. asks how to bleach the hair of an animal. A. Gaseous chlorine and hydrogen peroxide are effectual agents in bleaching hair. The hair should be thoroughly cleaned, with a warm solution of soda, then washed with water. While moist it is put into a jar and chlorine gas introduced, until the air in the jar looks greenish. Allow it to stand for twenty-four hours, and if necessary repeat.

(4608) T. H. says: 1. It is proposed to deliver water in an inch pipe one mile distant over an elevation 120 feet high, the point of delivery is 25 feet lower than the starting point. It is asserted that it would require 75 per cent more force power to deliver at the summit and let it go down by gravity than to continue the pipe the whole distance. Can you throw light on it? A. It will require 52 pounds pressure and the additional pressure due to friction to deliver the water at the summit of the siphon. The down leg can only relieve the pump pressure to the amount of a vacuum, or 14·7 pounds, which may be offset by the friction in the down leg of the siphon. The difference in length of the two legs of the siphon may make a trifling difference only, whether delivery is through the whole length or discharged at the top. 2. Suppose that a shell made of strong steel 1½ feet in diameter, with a cavity in the center large enough to hold 2 ounces of powder (1½ inches), with a vent of a size to admit the smallest possible wire that would conduct electric fluid, had electricity applied, would the powder ignite? Would there be an explosion, or what would there be? A. The powder would explode and create a pressure of probably 40,000 pounds per square inch, which would fizzle out through the vent and burn out the wire.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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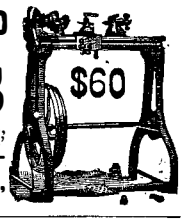

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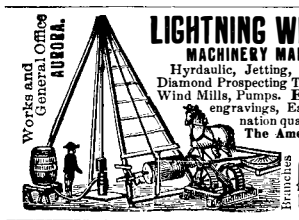

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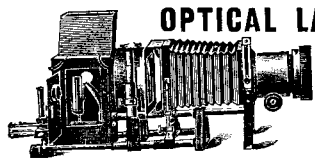

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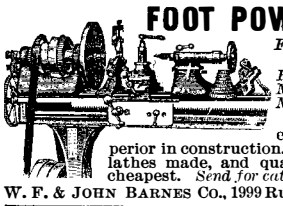

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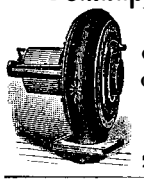

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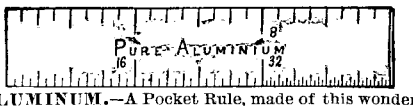

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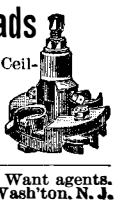

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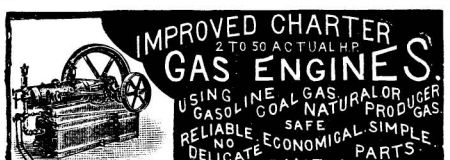
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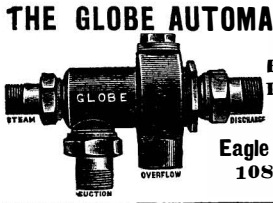

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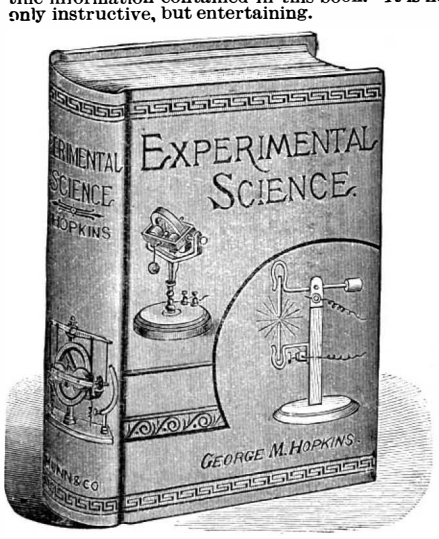

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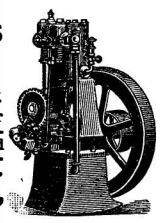

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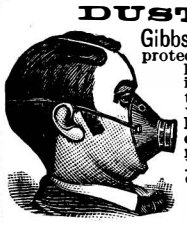

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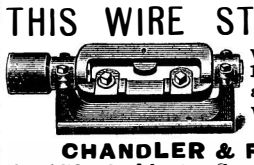

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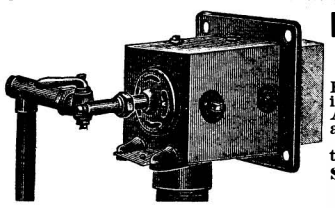

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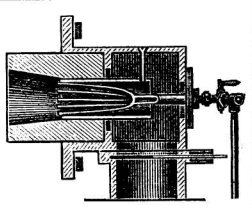

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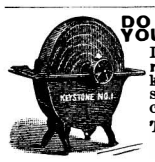

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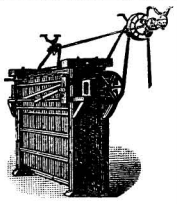

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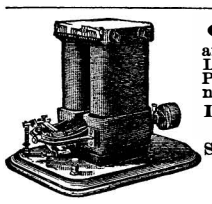

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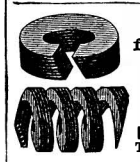

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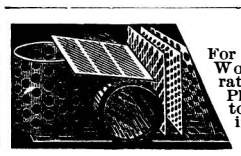

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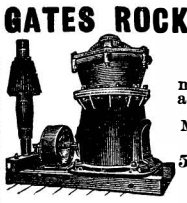

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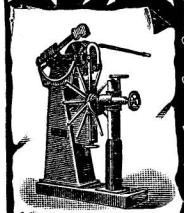

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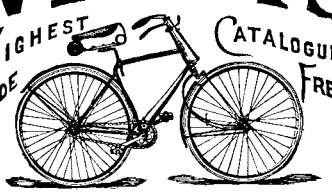

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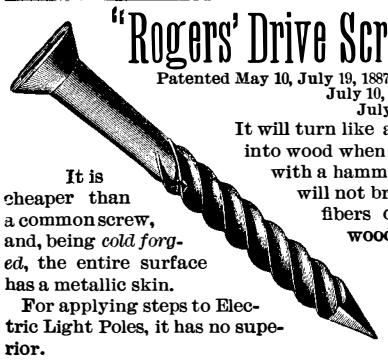

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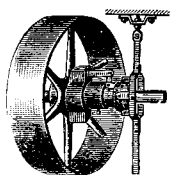

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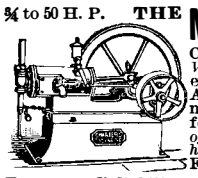

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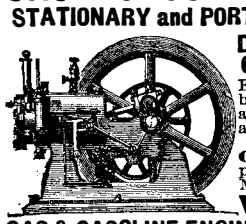

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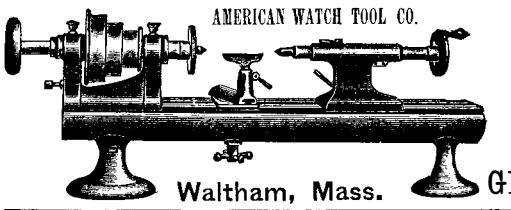

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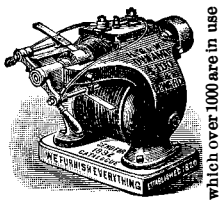

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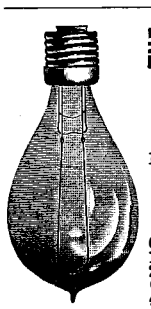

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